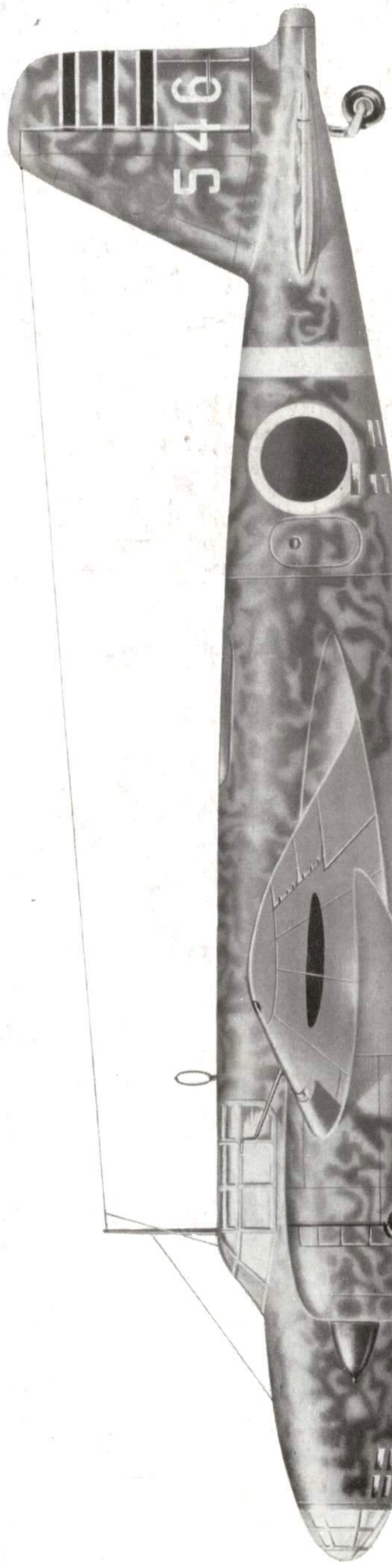
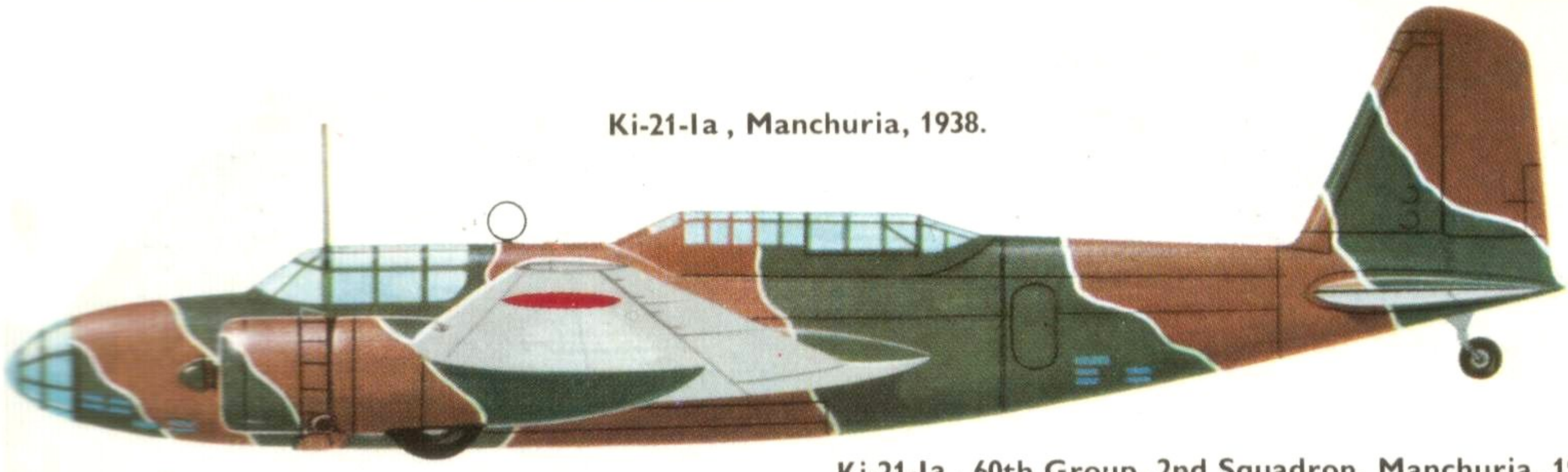
# PROFILE PUBLICATIONS

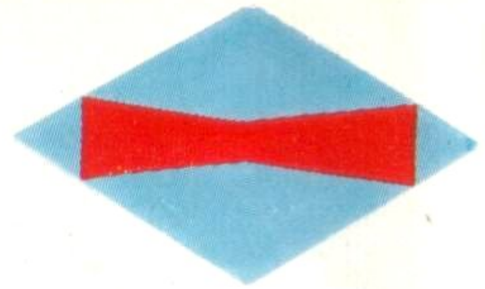
# The Mitsubishi Ki-21




NUMBER 172

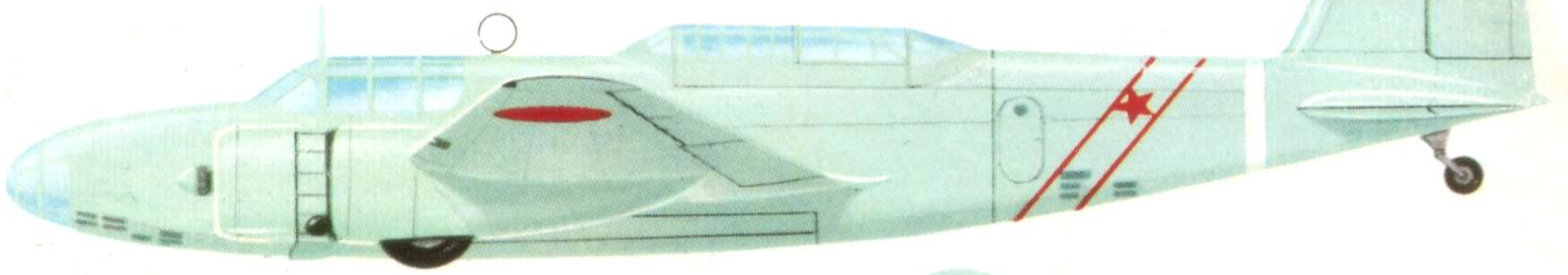
Ki-21-Ia , Manchuria, 1938.

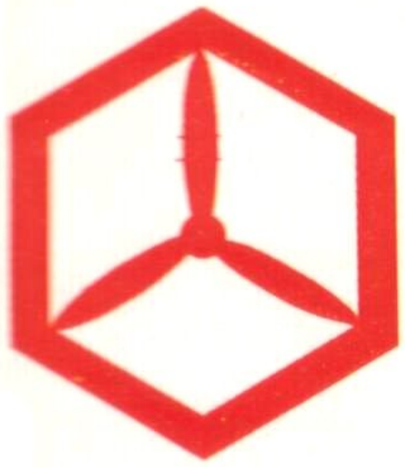




4th Air Division H.Q. Flight.

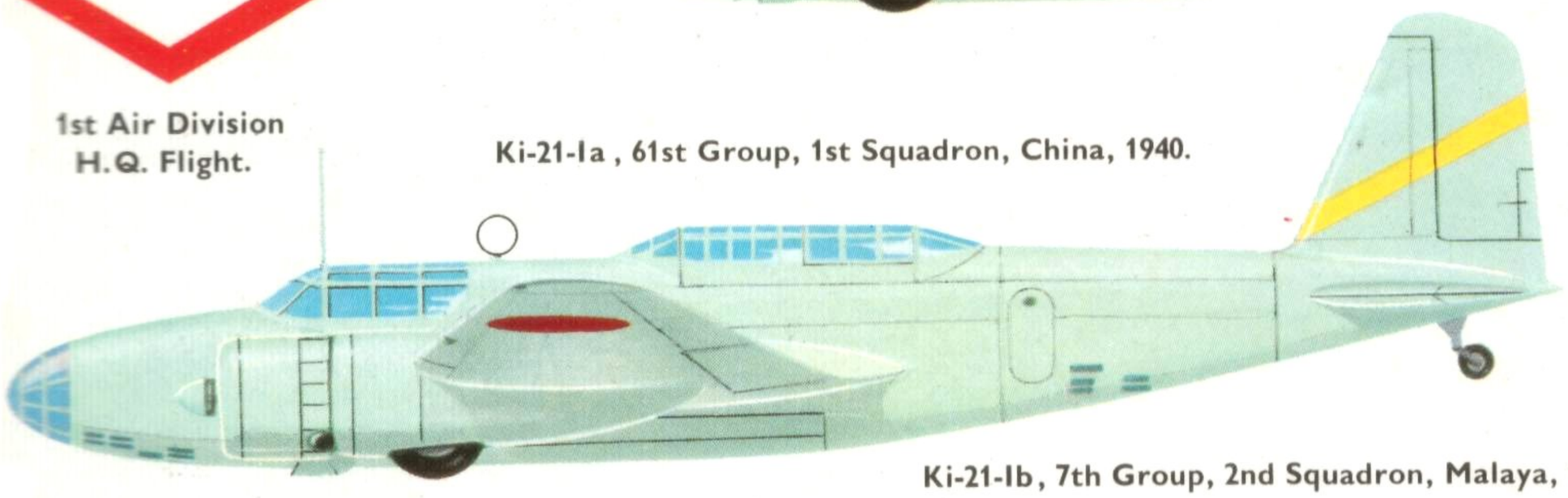
Ki-21-Ia , 60th Group, 2nd Squadron, Manchuria, 1939.





1st Air Division H.Q. Flight.

Ki-21-Ia , 61st Group, 1st Squadron, China, 1940.



2nd Sqdn., 61st Grp.

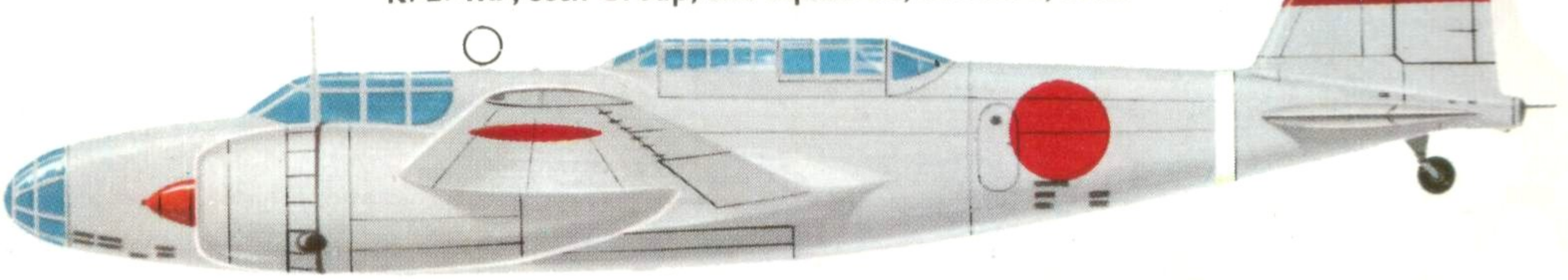
Ki-21-Ib, 7th Group, 2nd Squadron, Malaya, 1942.

1st Air Division H.Q. Flight, 1942-45.

Ki-21-Ic , 12th Group, 3rd Squadron, China, late 1942.

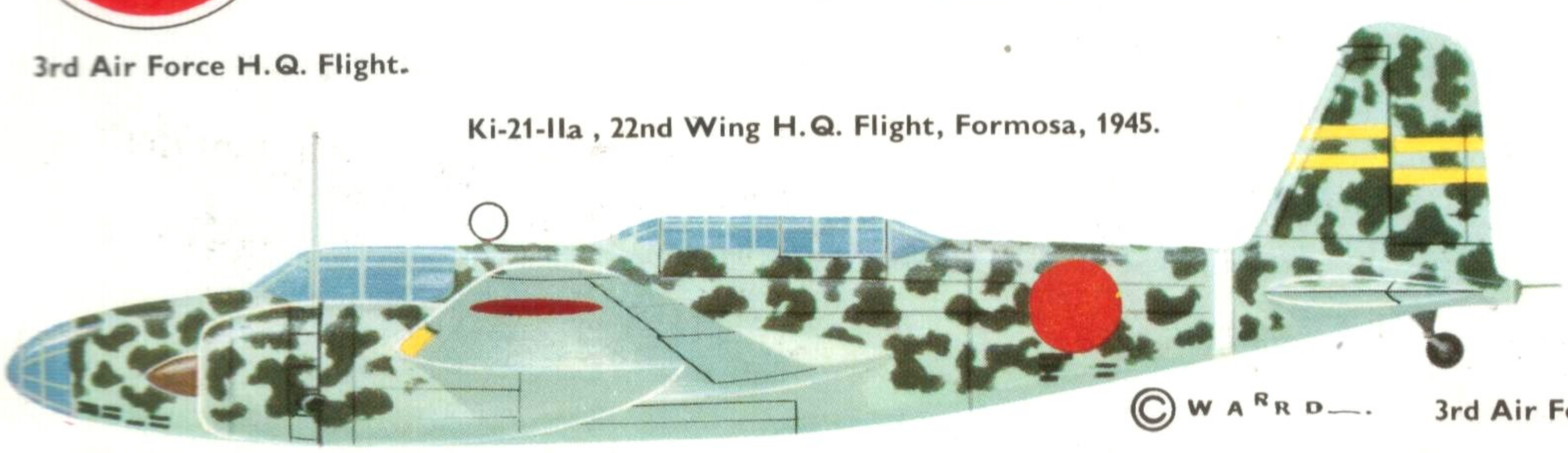
4th Air Division H.Q. Flight, 1942-45.

Ki-21-IIa , 58th Group, 2nd Squadron, Sumatra, 1942.



3rd Air Force H.Q. Flight.

Ki-21-IIa , 22nd Wing H.Q. Flight, Formosa, 1945.



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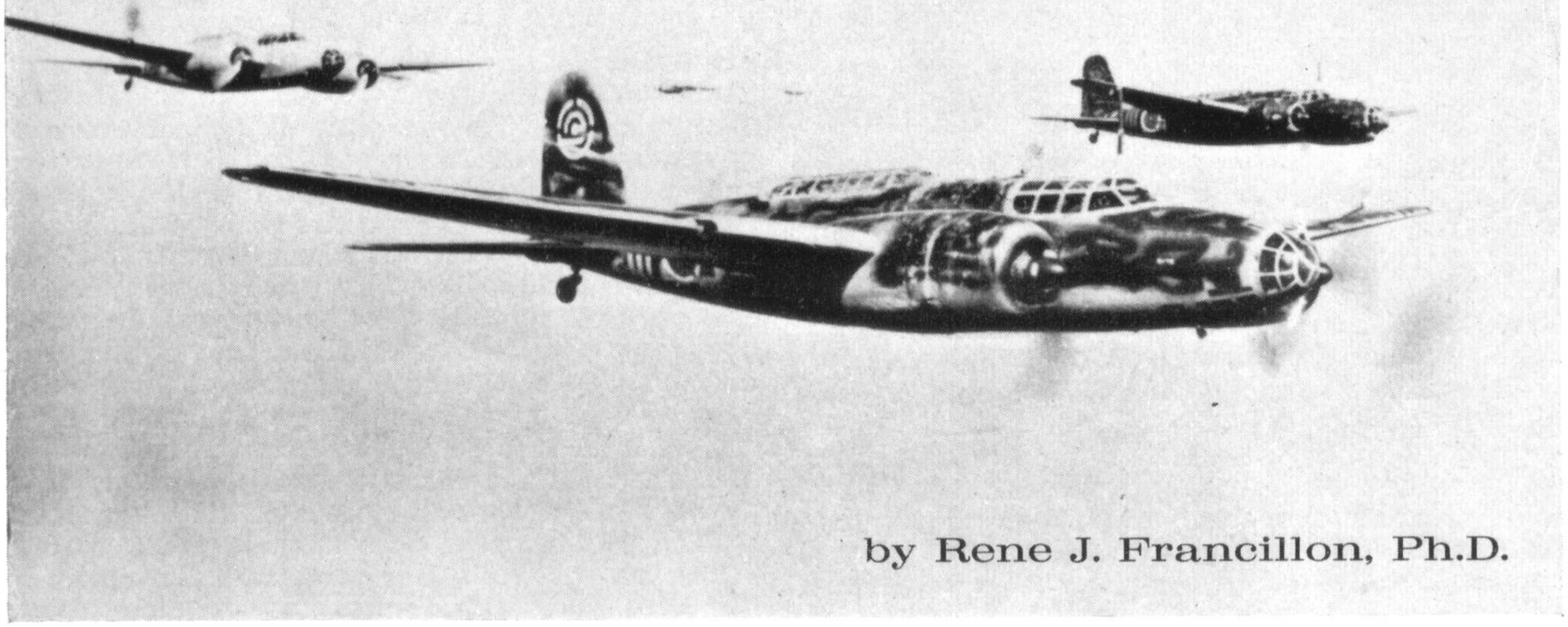
3rd Air Force H.Q. Flight, 1942-45.

# The Mitsubishi Ki-21



by Rene J. Francillon, Ph.D.

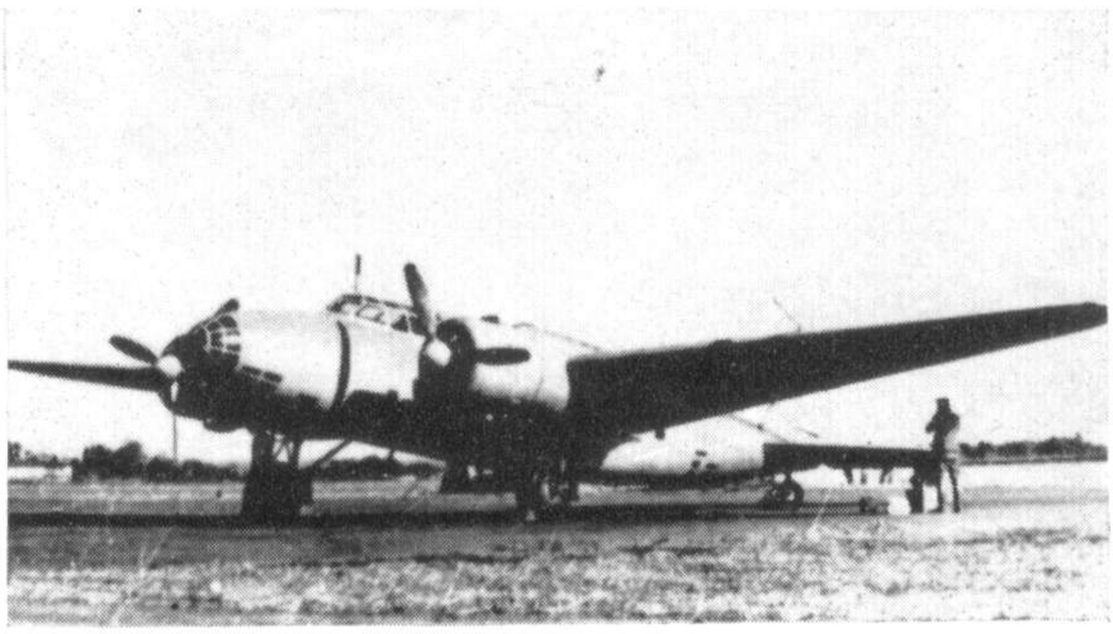
*Army Type 97 Heavy Bomber Model 2A (Ki-21-IIa) of the Hamamatsu Bomber Training School. More Ki-21-II's were built for the Imperial Japanese Army that any other type of heavy bomber; they formed the mainstay of that service's bomber force throughout the war.*
(Photo: Passingham/Klepacki Collection)

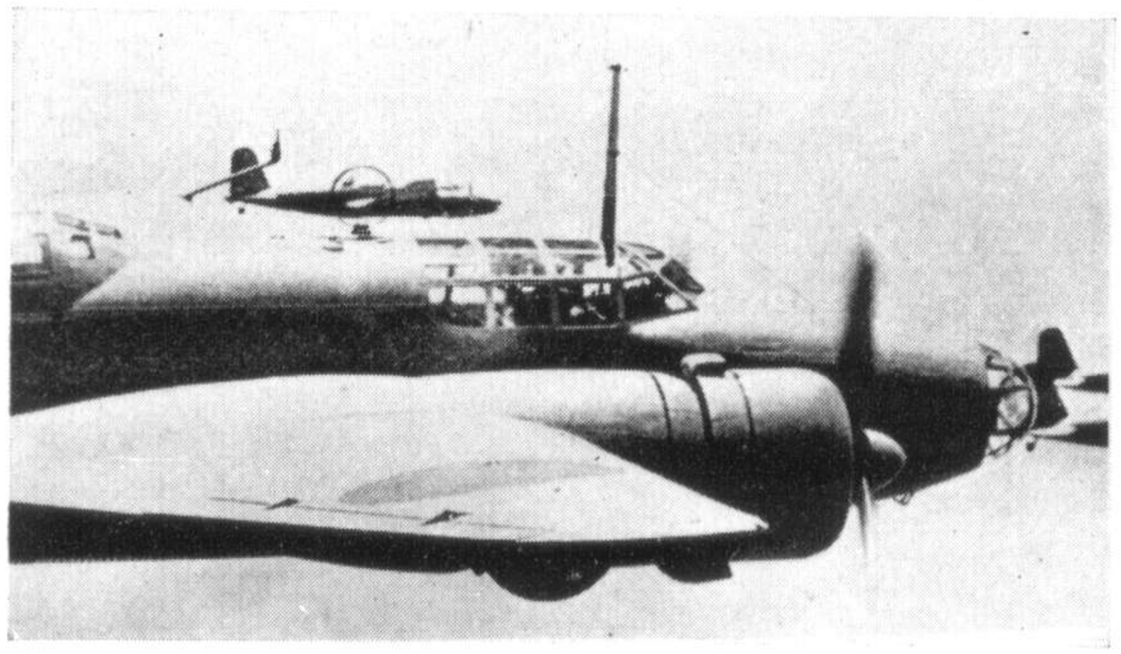
By the Treaty of Portsmouth in 1905 and the Treaty of Shantung in 1915 Japan had obtained control of the South Manchurian Railway in the Chinese province of Manchuria. However, Sino-Japanese relations over Manchuria were severely strained as a consequence of the many controversies and incidents which occurred in the twenties and early thirties. On 18th September, 1931 the Japanese alleged that a portion of one of the rails of the South Manchurian line was destroyed by a bomb explosion. The damage done was not serious in itself, but the consequences were far-reaching. The Japanese claimed that the bomb had been set off by Chinese soldiers. This was denied by the Chinese. Whatever the facts with respect to, and responsibility for, the explosion, the result was the initial occupation of Mukden and its environs by Japanese troops, and the gradual elimination of Chinese military and civil authority from Manchuria which culminated on 18th February, 1932 with the establishment of a new Japanese puppet state, Manchukuo, independent of China.

The Russian reaction to Japanese expansion took the form of intensive efforts to strengthen their military and economic positions in Siberia as, since the establishment of the puppet state of Manchukuo, Japan and Russia had in fact, if not in theory, a common frontier. As defensive measures, the U.S.S.R. increased railway construction, built an elaborate system of frontier defences and strengthened military effectives and air force units. This strengthening of the Russians from the military standpoint had the important effect of modifying the Japanese attitude and increased the long-existing latent fear of Russia felt in Japan. What to the Russians was clearly a defensive development could be pictured to the Japanese as an ultimate threat to their position in Manchuria and, through Manchuria, to Japan. From then on, whilst the Imperial Japanese Navy continued to foresee the United States as Japan's potential enemy in a major conflict, the Imperial Japanese Army prepared itself for a war against Russia. This policy was to influence very strongly the design of aircraft for the Imperial Japanese Army, one such aircraft being the Army Type 97 Heavy Bomber (Mitsubishi Ki-21).

On 15th February, 1936, just as a major incident broke out on the border of Outer Mongolia—an independent state looking to Russia for guidance and protection—and Manchukuo, the *Koku Hombu* (Air Headquarters) issued to Japanese aircraft manufacturers a specification calling for a twin-engined monoplane heavy bomber. Requirements included: (1) Performance: maximum speed over 400 km./h. at 3,000 m. (248·5 m.p.h. at 9,845 ft.); operating altitude: 3,000 m. to 4,000 m. (9,845 ft. to 13,125 ft.); climb to 3,000 m. (9,845 ft.) in 8 minutes; endurance: over

*Early production Ki-21-Ia prior to delivery to a service unit.*
(Photo: Archivio Fotografico Italo de Marchi)

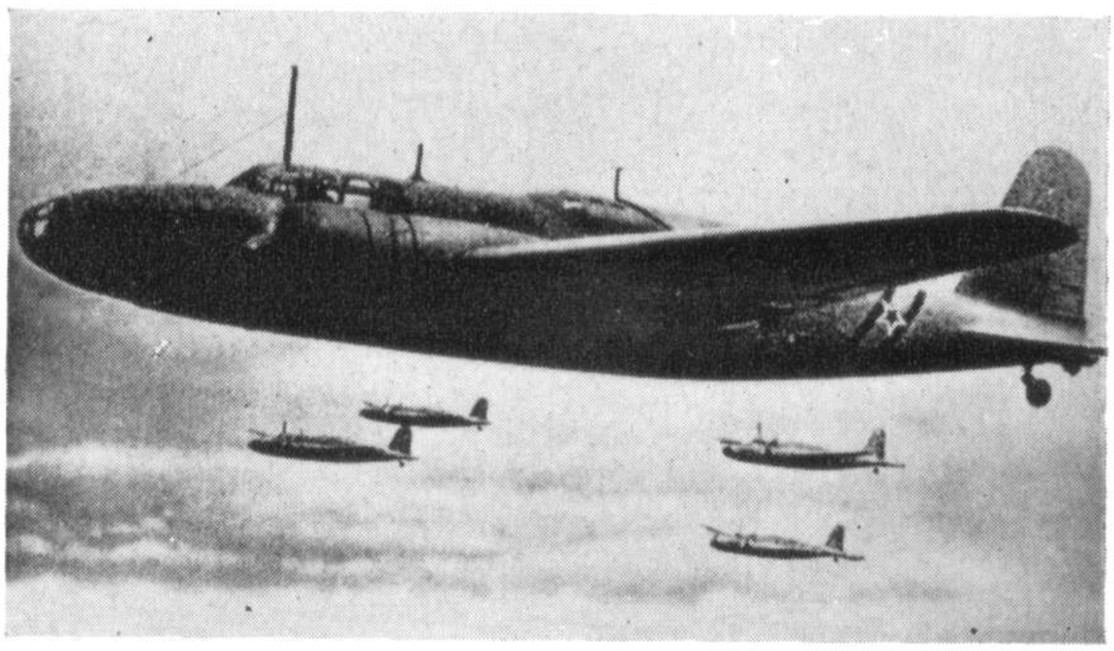




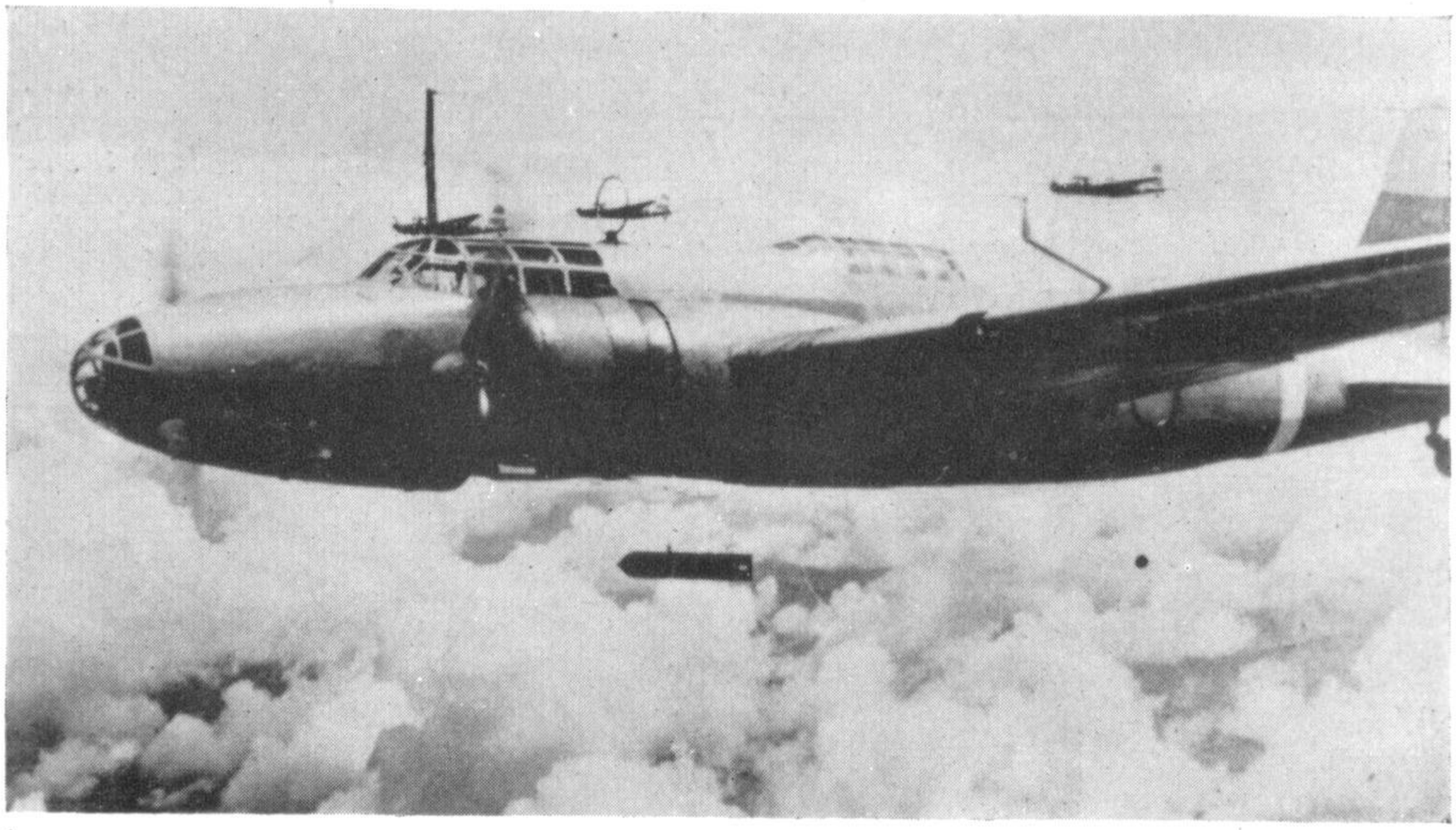
*Close-up of a Ki-21-I showing the radio antenna mast over the cockpit and the D.F. loop immediately behind.*
(Photo: Passingham/Klepacki Coll.)

5 hours at 300 km./h. (186 m.p.h.); take-off run less than 300 m. (985 ft.). (2) take-off weight less than 6,400 kg. (14,110 lb.). (3) Armament: three flexible 7·7 mm. machine guns and a normal bomb load of 750 kg. (1,653 lb.) or a maximum bomb load of 1,000 kg. (2,205 lb.). (4) Powerplant: either two 850 h.p. Nakajima Ha-5's or two 825 h.p. Mitsubishi Ha-6's. (5) Crew of four consisting of pilot, co-pilot/navigator, bombardier/gunner and radio-operator/gunner. (6) Undercarriage: main gear retractable. (7) Ability to operate in extreme cold weather. (This last requirement stemmed from the anticipated use of the aircraft in operations against Russia in the Manchukuo/Siberia area.) The aircraft was to replace the obsolescent Army Type 92 Heavy Bomber (Ki-20) and Army Type 93 Heavy Bomber (Ki-1) both based by Mitsubishi on a Junkers design.

In answer to this specification, *Nakajima Hikoki K.K.* submitted its Ki-19, *Mitsubishi Jukogyo K.K.* the Ki-21 design and *Kawasaki Kokuki Kogyo K.K.* the Ki-22. Both the Nakajima and Mitsubishi proposals were selected by the *Koku Hombu* which ordered competitive prototypes from both firms. The design of the Mitsubishi entry, entrusted to a team led by Eng. Nakata and Ozawa, progressed swiftly despite the exacting requirements of the Imperial Japanese Army and, a mere nine months after the issuance of the official specification, the first of two prototypes was completed at Mitsubishi's 5th Airframe Works at Nagoya. Powered by two 825 h.p. Mitsubishi Ha-6's driving variable-pitch metal propellers, the aircraft was a cantilever monoplane with wing set at mid-fuselage above the ventral bomb-bay. Defensive armament included one 7·7 mm. Type 89 machine gun—movable only in the vertical axis—in a nose turret, a similar machine gun in a semi-hemispherical dorsal turret and a third Type 89 light machine gun firing from a ventral position in the stepped rear fuselage. The angular glazed nose containing the bombardier's position resembled that of the prototype Handley Page Hampden. In this form the first Ki-21 prototype made its first flight on 18th December, 1936. During the same month the second prototype, fitted with a long dorsal greenhouse which was to characterize production aircraft until the advent of the Ki-21-IIb, was completed and both aircraft were first assigned to the manufacturer's flight test programme. Between March and May 1937, these two aircraft were pitted against the first two Ha-5 powered Nakajima Ki-19's in competitive trials held at Tachikawa Air Base. The Ki-21 revealed itself somewhat faster than its Nakajima rival and had the added advantage of a lighter wing loading but the Ki-19 had more pleasant flight characteristics and the Imperial Japanese Army appeared to favour its Nakajima Ha-5 engines over the Mitsubishi Ha-6 engines of the Ki-21. Bombing tests were held in June at Hamamatsu and during these tests the Mitsubishi proved inferior to the Ki-19 as it offered a less stable bombing platform. However, the superior performance of the Mitsubishi design had sufficiently impressed the Imperial Japanese Army to warrant further tests between modified prototypes and accordingly Mitsubishi and Nakajima were instructed to deliver additional aircraft suitably modified. At the same time the two manufacturers were instructed



(Above) *A formation of Ki-21-Ib's from the 60th* Sentai, *2nd* Chutai *photographed during a mission over the Chinese mainland.* (Photo: via the author)



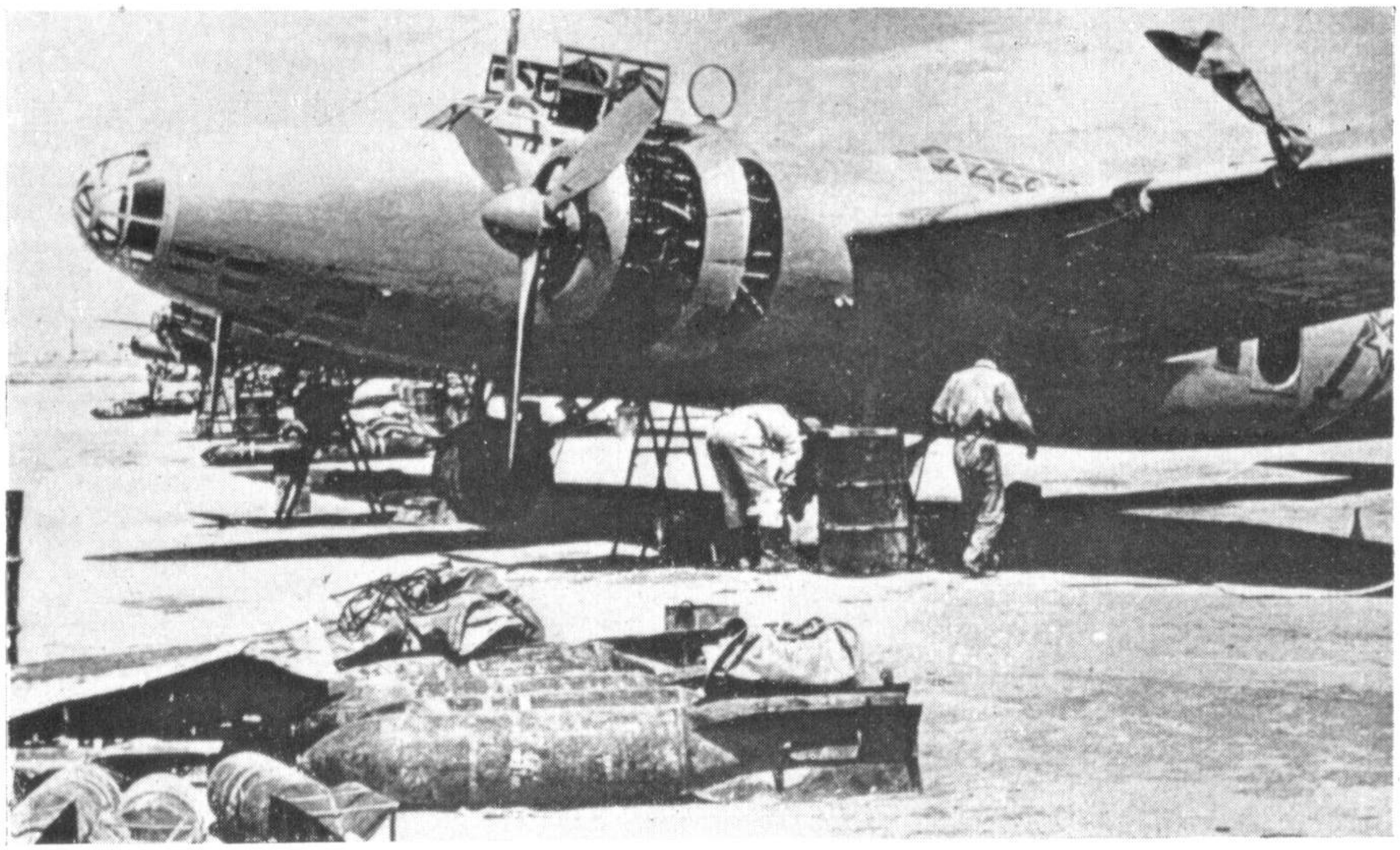
(Left) *A Ki-21-Ib of the 60th* Sentai, *3rd* Chutai *releasing its bombload over a Chinese target. Vulnerable to fighter attack, the Ki-21-I proved less than satisfactory from a defensive point of view even in the earliest stages of the Pacific War.*
(Photo: Aeroplane Photo Supply via the author)

to switch engine types for these additional aircraft. Thus the next aircraft delivered by Mitsubishi made use of Nakajima Ha-5's and the third and fourth Ki-19 were powered by Mitsubishi Ha-6's. The third Ki-21 built was the first to be powered by a pair of Ha-5's and, in addition, had a revised fuselage with hemispherical nose housing a 7·7 mm. Type 89 machine gun on a ball-and-socket mount and the ventral step was removed. To improve stability, particularly during the bomb run, the shape of the rudder was modified and its area increased. Thus modified, the Ki-21 won easily the competition against the Nakajima Ki-19 and, in November 1937, the Imperial Japanese Army signed a contract with Mitsubishi for the production of the aircraft as the Army Type 97 Heavy Bomber Model 1. Mitsubishi was also instructed to use the 850 h.p. Army Type 97 radial, the production version of the Ha-5, rated at 950 h.p. on take-off and delivering 1,080 h.p. at 4,000 m. (13,125 ft.), and to increase petrol tank capacity from 1,840 litres (405 Imp. gallons) to 2,635 litres (580 Imp. gallons). Before delivery of production aircraft began, five additional service trial aircraft were built, all powered by Ha-5 engines, and were used to test various equipment changes and armament as requested by the Imperial Japanese Army. In particular, a remotely-controlled tail "stinger" and waist gun positions, features which were adopted for later versions of the aircraft, were tested.

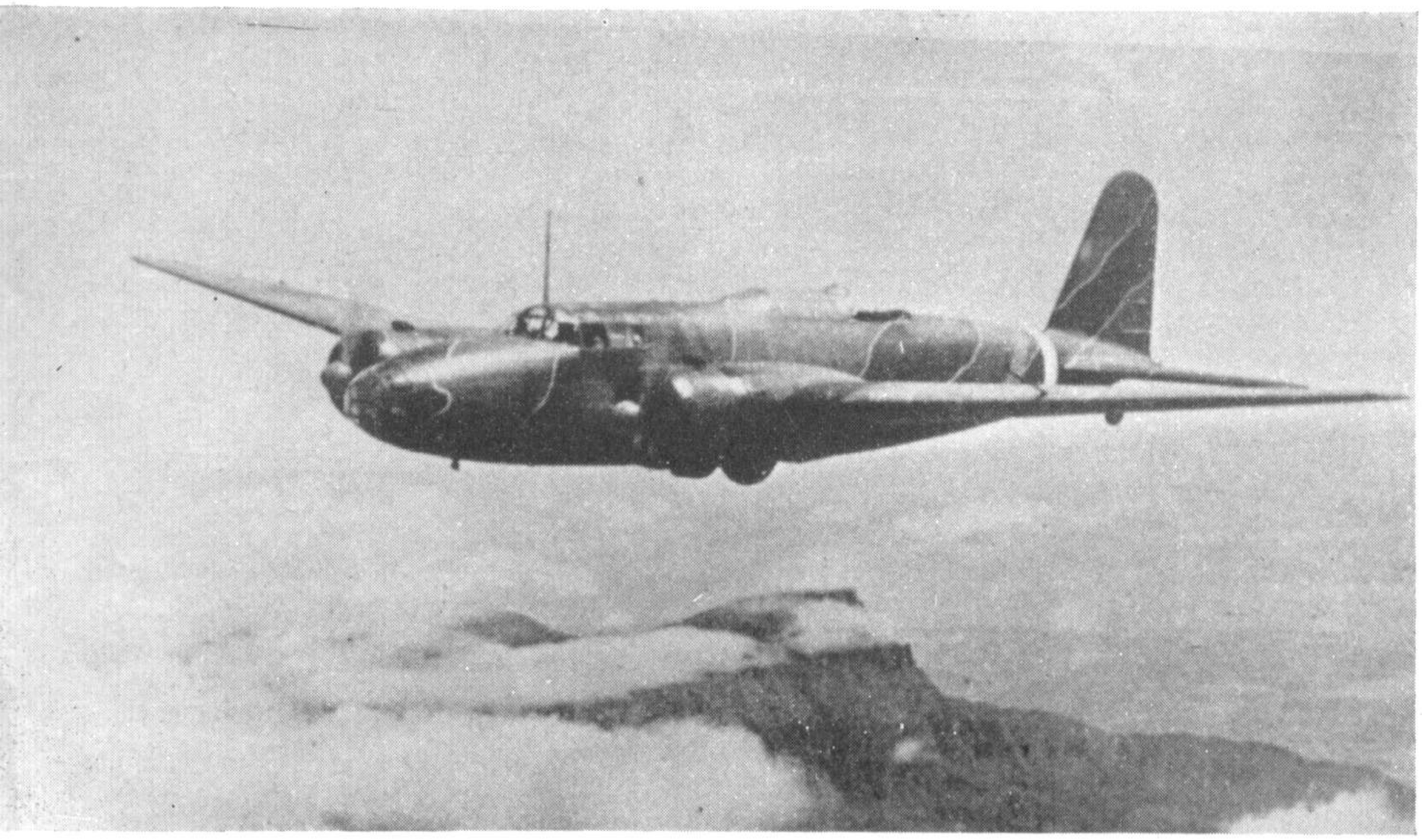
## EARLY COMBAT OPERATIONS IN CHINA

When the Second Sino-Japanese Incident broke out in July 1937, the Ki-19 and Ki-21 were still competing against each other and delivery of production aircraft was still several months away. Thus the Imperial Japanese Army found itself without modern heavy bombers and had to let the rival Imperial Japanese navy carry the brunt of the air offensive against China. To bridge the gap until sufficient number of Ki-21's would be available they placed an initial order for 75 Fiat B.R.20's (see *Profile* No. 110), later increased to 85, whilst production of the Ki-21-I was accelerated by placing a contract with *Nakajima Hikoki K.K.* Operating against the Chinese before the Army Type 97 Heavy Bomber, the Italian aircraft was never too popular with its Nipponese crews despite the fact that its bomb load was nearly twice that of the Japanese machine. As soon as the 60th *Sentai*, the first unit to receive production Ki-21-Ia's (starting in August 1938), had received sufficient aircraft and had completed training, it was placed in operation in Manchuria against Chinese provinces in the North where it was joined by the similarly equipped 61st *Sentai*. Although liked by their crews, the Ki-21-Ia's did not fare too well in operations against Chungking and Lanchow as, flying without escort due to the lack of range of contemporary J.A.A.F. fighter aircraft, their meagre defensive armament was insufficient to defend themselves successfully and losses were alarmingly high. These aircraft also played a minor part in the Nomonhan Incident which saw large formations of Japanese and Russian fighter aircraft pitted against each other.

After producing 143 Ki-21-Ia's Mitsubishi switched to the Ki-21-Ib, or Army Type 97 Heavy Bomber Model 1B, in which an attempt was made to correct some of the deficiencies revealed in early combat operations. The petrol tanks were partially protected by laminated rubber sheets and the defensive armament was increased by two 7·7 mm. Type 89 machine guns—one mounted as a "stinger" in the extreme tail of the aircraft and being remotely-controlled and the other one firing through lateral openings on either side of the rear fuselage—whilst the bomb-bay was enlarged. To improve flight and handling characteristics the landing flaps were enlarged as were the horizontal tail surfaces, the total area of the latter being increased from 10·82 sq. m. (116·465 sq. ft.) to 11·32 sq. m. (121·847 sq. ft.). One hundred and twenty Model 1B (Ki-21 Nos. 152-271) were built by *Mitsubishi Jukogyo K.K.* and were followed by one hundred and sixty Model 1C, or Ki-21-Ic, (Ki-21 Nos. 272 to 431). The Ki-21-Ic received an additional lateral machine gun, bringing total defensive armament to six flexible 7·7 mm. Type 89 machine guns, and had provision for a 500-litre (110 Imp. gallons) petrol tank mounted in the rear bomb-bay which increased total petrol tank capacity to 3,135 litres (690 Imp. gallons) and necessitated the fitting of main wheels of increased diameter. When the bomb-bay tank was fitted, four 50 kg. (110 lb.) bombs could be carried externally. The 431st Mitsubishi-built Ki-21, the last of the Ki-21-I series, was delivered in December 1940 whilst



*This aircraft of the 60th* Sentai, *2nd* Chutai *on a Chinese airfield displays the unit insignia on the rear fuselage, a peculiarity of the 60th* Sentai. *The tail surfaces were normally the background for I.J.A.A.F. unit insignia.*
(Photo: Passingham/ Klepacki Coll.)



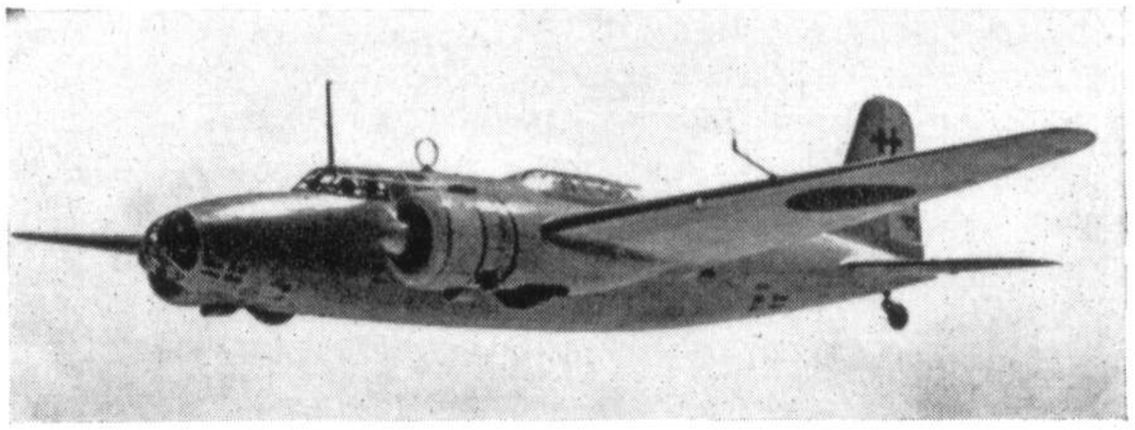
(Left and below) *Two views of the Ha 5 KAI-powered Ki-21-Ia; the upper machine is finished in the segmented camouflage adopted for operations in Manchuria.*
(Photos: Passingham/ Klepacki Coll.; Mitsubishi Jukogyo K.K.)

the 351st and last Nakajima-built Ki-21 was completed in February 1941.

The Ki-21-Ib's and -Ic's quickly replaced the -Ia's in front line units, the earlier aircraft being relegated to training units and to ancillary duties, some being converted to MC-21 cargo transport configuration for service with *Dai Nippon Koku K.K.* The latter versions of the Ki-21-I obtained better results in China but this was mainly due to the virtual elimination of the Chinese Air Force. A false feeling of security amongst the Imperial Japanese Army's bomber crews resulted from this situation but this was shattered when, early during the Pacific War, they found themselves opposed by P-40's of Chennault's Flying Tigers and by R.A.F. Hurricanes.

## ENTER THE Ki-21-II

The confidence of the bomber crews was not shared by the *Koku Hombu* which insisted that Mitsubishi develop a higher performance version of the Ki-21. So far modification efforts had only been directed towards increasing range, defensive armament and petrol tank protection. Now was the time, according to the *Koku Hombu*, to increase speed and ceiling. Accordingly, in November 1939, Mitsubishi undertook to modify the first Ki-21-Ic (Ki-21 No. 272) by replacing the Nakajima Ha-5 engines by a pair of Army Type 100 fourteen-cylinder air-cooled radials (Mitsubishi Ha-101's) driving constant-speed propellers of increased diameter (3·40 m. versus 3·20 m.). The larger diameter of these engines necessitated an enlargement of the nacelles and Mitsubishi took advantage of this requirement to modify the main undercarriage retractation system and to fit drag-reducing wheel well coverings entirely enclosing the wheels within the contour of the engine nacelles. Once more it was found necessary to increase the size of the horizontal tail surfaces, their total area going from 11·32 sq. m. (121·847 sq. ft.) to 13.16 sq. m. (141·653 sq. ft.)—a 21·6 per cent. increase over the area of the original tail surfaces of the Ki-21. Results of the flight tests of the prototype Ki-21-II, which had begun in March 1940, were most encouraging and the *Koku Hombu* instructed Mitsubishi to commence production of the new version, as the Army Type 97 Heavy Bomber Model 2A, as soon as feasible



without disrupting delivery of operational aircraft. No production contract for the Ki-21-II was placed with *Nakajima Hikoki K.K.* as this firm was testing its Ki-49 with which it was eventually hoped to replace the Ki-21. The first four Ki-21-II's to come off Mitsubishi's assembly lines in December 1940 were used as Service trial aircraft and were immediately followed by Ki-21-IIa's to full production standard and incorporating minor equipment changes. Five hundred and ninety Army Type 97 Heavy Bomber Model 2A's were built.

The failure of the Army Type 100 Heavy Bomber *Donryu* (Nakajima Ki-49) to provide the Imperial Japanese Army with a worthwhile replacement for the ageing Ki-21 necessitated the development of a newer version of the faithful mainstay of the J.A.A.F. heavy bomber force. The main criticism directed by its crews towards the Ki-21 was still its inadequate defensive armament, and the limited field of fire of the dorsal 7·7 mm. machine gun was often deplored. When it was found necessary to continue production of the Ki-21, Mitsubishi was instructed to remedy this deficiency. The long dorsal greenhouse was dispensed with—the upper fuselage contour being cleaned up—and a large conical turret housing a flexible 12·7 mm. Type 1 machine gun and operated by bicycle pedals with chain drive for gun traverse was mounted on the upper fuselage just behind the wing trailing edge. Although the new dorsal gun had a higher muzzle velocity and a wider field of fire this was only a token increase as no change was made to the rest of the defensive armament. Small equipment changes and improved petrol protection were incorporated but the Ki-21-IIb, as the new version of the aircraft was designated, was identical to earlier machines in all other features. Starting with the

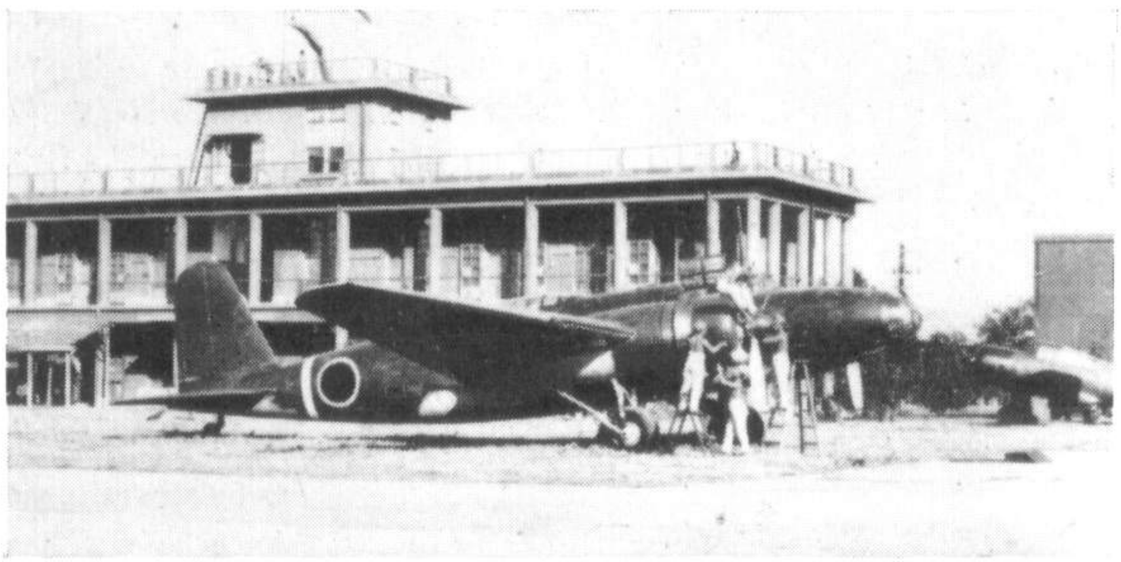
Ki-21 No. 1026, all Army Type 97 Heavy Bombers delivered were of the Model 2B version. Further changes were introduced on the assembly lines commencing with the 1,300th Ki-21 which was fitted with 16 mm. armour plates in front of the first pilot and behind the dorsal gunner and with a 12·5 mm. armour plate protecting the back and head of the first pilot. The last of 688 Ki-21-IIb's was delivered in September 1944, almost eight years after the first Ki-21 had been completed. Total Ki-21 production, including prototypes and Nakajima-built aircraft, totalled 2,064 machines.

## THE Ki-21 IN THE PACIFIC WAR

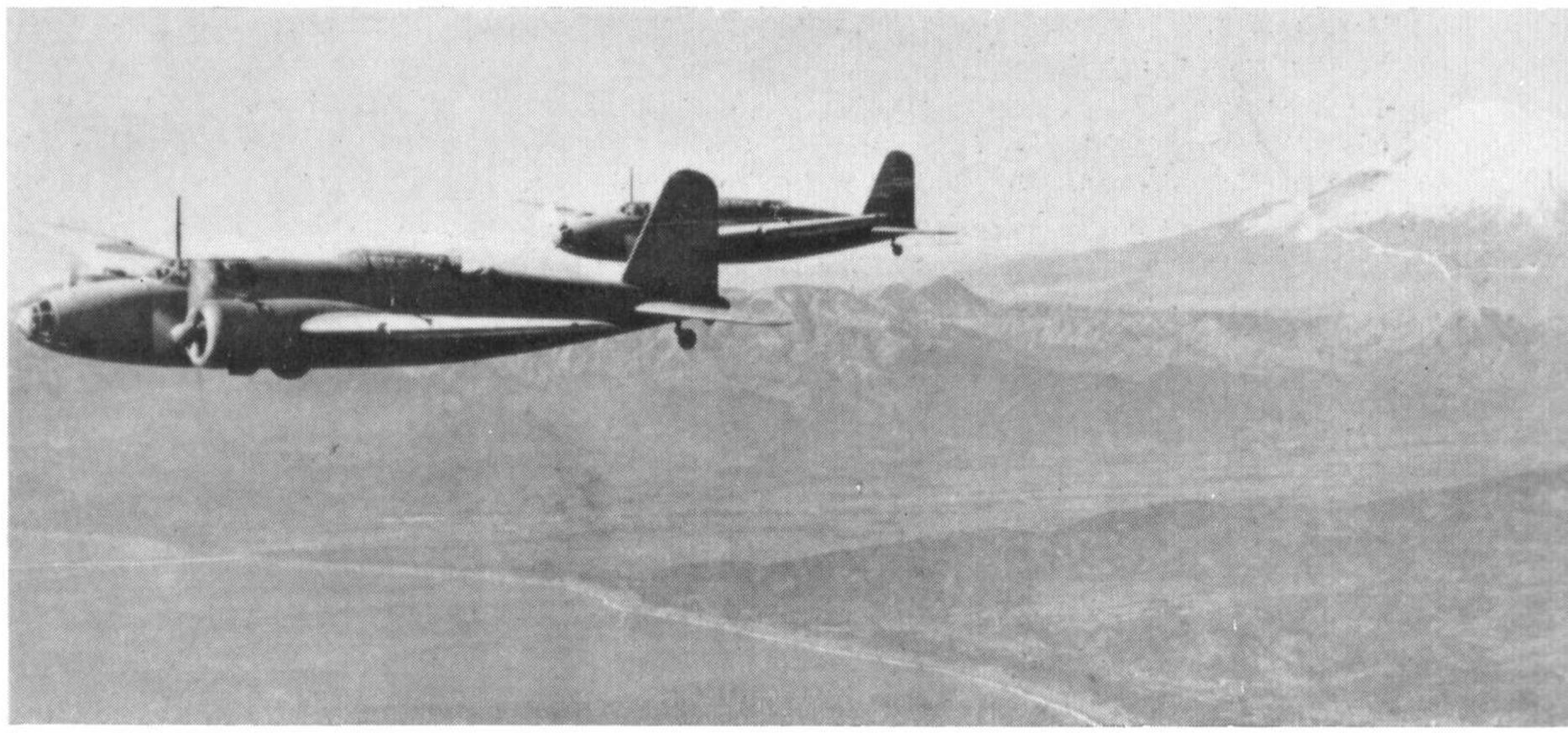
As the Japanese were about to begin their operations against the Allies, the heavy bomber units were still flying some Ki-21-I's but most of them flew Ki-21-IIa's. Lacking long-range aircraft, the Imperial Japanese Army was assigned the task of carrying out operations against the Chinese and of supporting the invasion of Malaya and Burma whilst the land- and carrier-based aircraft of the Imperial Japanese Navy were deployed in support of the operations against the American forces in the Pacific. For the air assault on Malaya the Imperial General Headquarters had assigned the 3rd *Hikoshidan* (Air Division), which had been transferred from the Japanese expeditionary force in China to the Southern Army in Indo-China under the command of Lieutenant-General Michiyo Suguwara. The 3rd *Hikoshidan* consisted of ten Sentais—four of fighters, three of light bombers, one of reconnaissance aircraft and three of Army Type 97 Heavy Bombers (87 aircraft)—and mustered a total of 364 aircraft. Deployment of the 3rd *Hikoshidan* from China was not completed until the day before the invasion of Malaya and, due to lack of shipping space from Japan, supplies of aircraft spare parts and ammunition were strictly limited. To complicate the matter further, Phnom Penh airfield, where most of the bombers were based, was deluged by a heavy rain squall just before the air attacks on Malaya were to begin. Despite these difficulties one unit based at Saigon was able to provide air support to the landing forces at Kota Bharu. Other units of the 3rd *Hikoshidan* were assigned to the ground forces simultaneously invading Thailand. For the next two months, until Singapore surrendered on 15th February, 1942, the Ki-21 of the 3rd *Hikoshidan* supported specifically army operations whilst the attack bombers of the Imperial Japanese Navy 22nd *Koku Sentai* (Air Flotilla) were assigned the tasks of destroying Allied air power on the ground, of bombing strategical targets in and around Singapore, and of destroying Allied sea power. During these operations air opposition was negligible as the R.A.F. Brewster Buffaloes were completely outclassed by the Japanese fighters escorting the bombers and Japanese aircraft losses were small. The task of the Ki-21's attacking Hong Kong, where no British fighters were available, was even easier. The British and Canadian garrison endured persistent bombing but admired the skill and daring of the Japanese airmen. Indeed so thoroughly had they absorbed the Western misconception about Japanese airmen and aircraft that they believed German pilots were leading the enemy squadrons into battle. The irony of this is given a special twist by the fact that truth was available so very close at hand—in the bitter air war the Japanese had been waging over China in the previous four years.

When the Ki-21's first encountered the P-40's of the American Volunteer Group on 20th December, 1941 over Kumming, the situation took a turn for the worse. Three days later, during an attack by 60 Ki-21's escorted by 20 fighters against Rangoon and Mingaladon airfield, the defending fighters of No. 67 Squadron, R.A.F., and the A.V.G. succeeded in destroying 20 bombers for the loss of two of their pilots. This action was typical of the results when the Army Type 97 Heavy Bombers were met by more modern Allied aircraft and determined and experienced pilots. Fortunately, for the Japanese, modern Allied fighter aircraft—including an increasing number of R.A.F. Hurricanes—were "too few, too late" and Rangoon fell in March, 1942.

(*continued on page 10*)



*A Ki-21-Ia in late-style camouflage with yellow wing leading edge identification panels.* (Photo: R. Bueschel)



(Right) *An attractive study of Ki-21-Ia's of the Hamamatsu Bomber Training School flying over a typical landscape.* (Photo: R. Bueschel)

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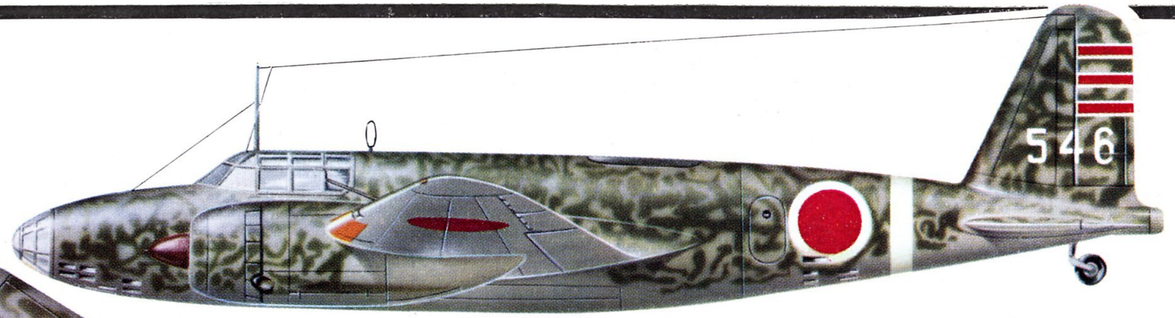
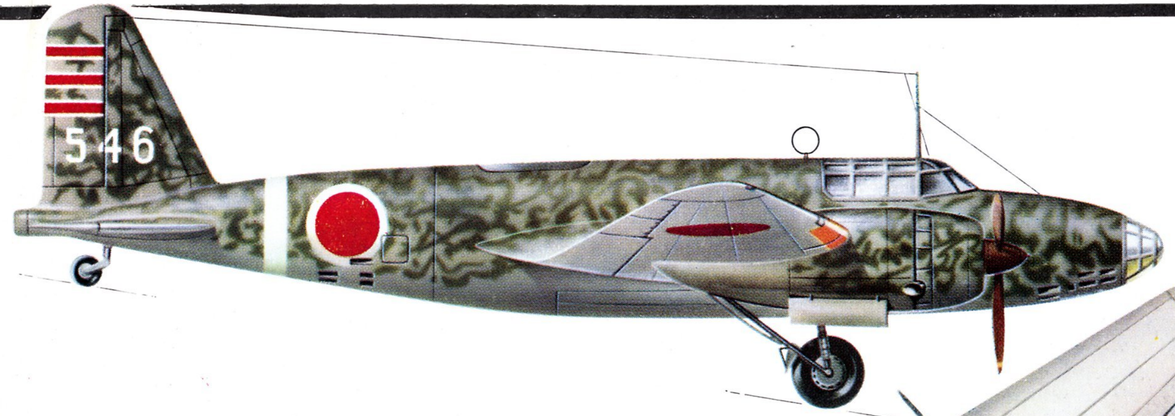
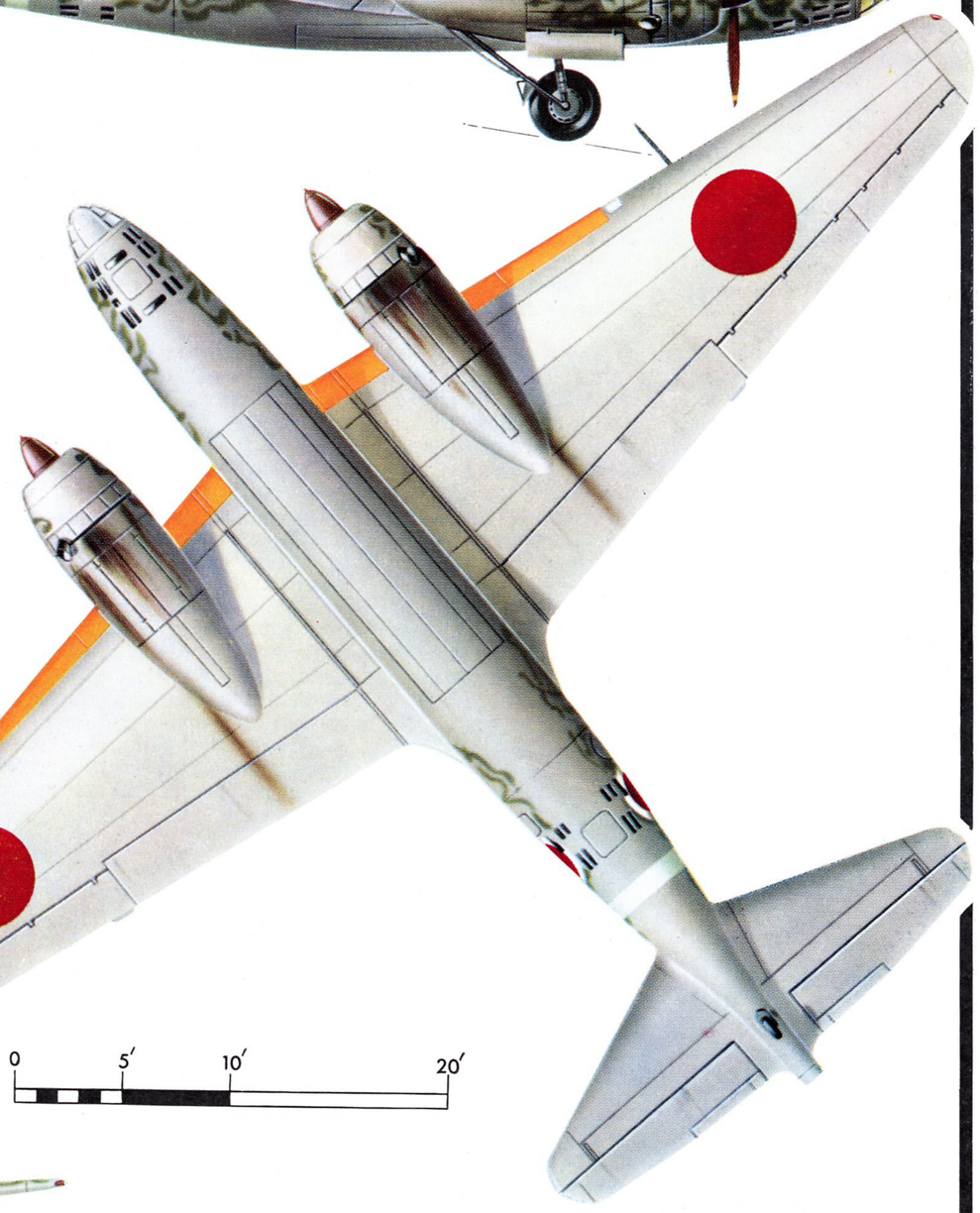
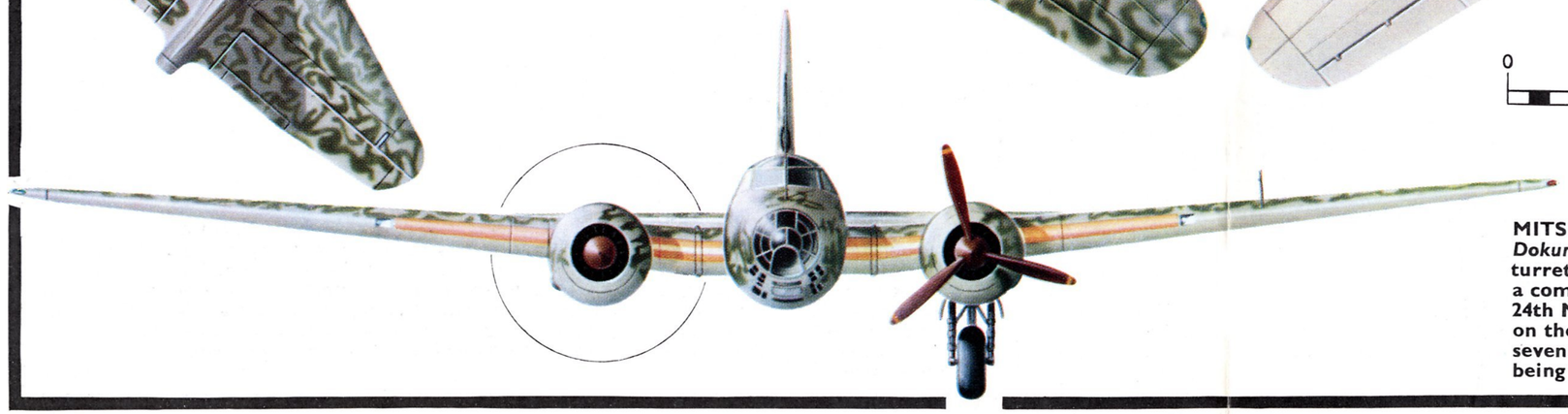


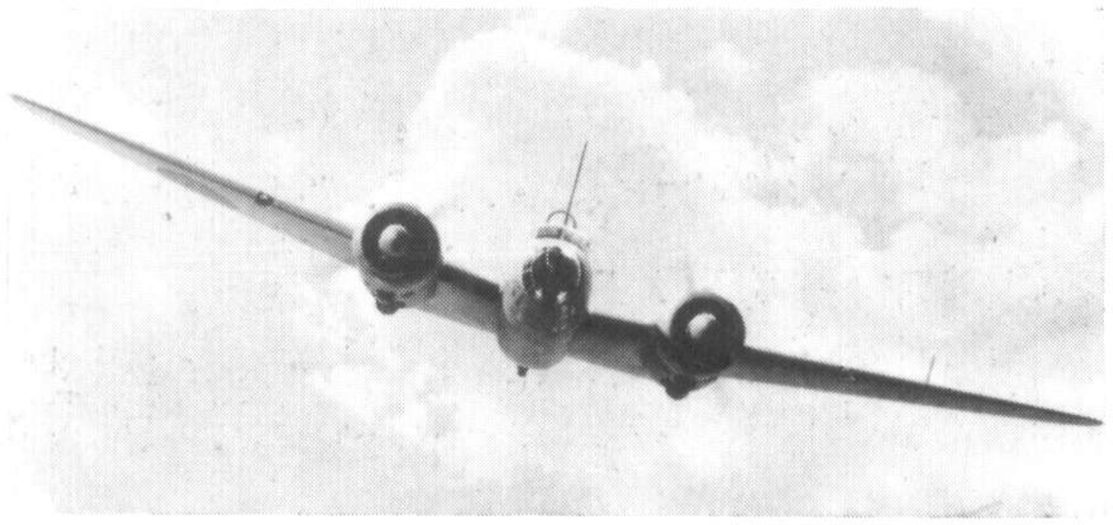










**MITSUBISHI Ki-21-IIb (Army Type 87 Heavy Bomber, Model 2B) of the *3rd Dokuritsu Hikotai*, Imperial Japanese Army Air Force. The aircraft, with dorsal turret removed and stripped of all armament, was one of nine despatched on a commando mission against the American-held Yontan airfield on Okinawa on 24th May, 1945. This was the only machine to reach the objective; it crash-landed on the airfield and the twelve Japanese troops it carried succeeded in destroying seven aircraft, 2,600 drums of fuel and large quantities of ammunition before being overrun.**



*Head-on view of the Army Type 97 Heavy Bomber Model 1; note tall antenna mast and D.F. loop over cockpit.*
(Photo: U.S. National Archives)

In the South-west Pacific, the Imperial Japanese Army had turned its attention towards the Dutch East Indies and New Guinea area. Once again the Ki-21's, benefiting from the attackers' advantage of choosing the time and place to strike, operated successfully. By July, 1942 the Japanese advance in the Pacific had reached its limits and the long fight back to Japan began. In New Guinea, the Army Type 97 Heavy Bombers seldom operated in large numbers and, with the increasing availability of high performance Allied fighter aircraft, losses rose sharply. Although popular with its crews because of its good serviceability and pleasant handling characteristics, the Ki-21 never could be considered a successful aircraft in the taxing environment under which it was called to operate once the Allied offensive gained tempo. Furthermore, with its comparatively light bomb load, twin-engined configuration and mediocre defensive armament, the Ki-21 could never be considered as a heavy bomber by Allied standards of the mid-war years. Known as "Sally" to the Allies, the aircraft was considered an easy target and its defensive armament was wholly inadequate even in its Ki-21-IIb version, this being coded for a while "Gwen" as early combats reports failed to identify it as a development of the "Sally".

In the China-Burma-India theatre the Ki-21's did not fare any better either at the hands of the U.S. Fourteenth Air Force or of the Royal Air Force. One of the most notable actions in this theatre was the series of offensive air actions mounted by the Imperial Japanese Army against Calcutta in December, 1943. Despite a reasonable ratio of escorting fighters to bombers, the Japanese units never stood much of a chance against the defending Spitfire squadrons. For example, on 31st December, 1943, No. 136 Squadron, R.A.F., shot down eight out of fourteen Sallys and three out of fifteen Oscars* attacking light naval units in the Bay of Bengal.

Japanese heavy bombers usually formated in multiples of 9 (three "Vics" of three aircraft each). Attacks were characterized by a long approach in formation, held persistently regardless of anti-aircraft fire and/or fighter opposition. Bombs usually were dropped on a signal from the leader at altitudes ranging from 5,000 to 20,000 feet, depending upon the nature of the target and the opposition. Generally, the formation was well maintained until bombs were dropped, when it was loosened up somewhat. The flights then engaged in a series of evasive tactics against anti-aircraft fire, the bombers surging up and down, gaining and loosing about 500 feet in altitude. Fighter escort on bomber missions varied according to the opposition expected and the number of fighters available. The position and escort technique of fighters protecting bomber formations constantly changed.

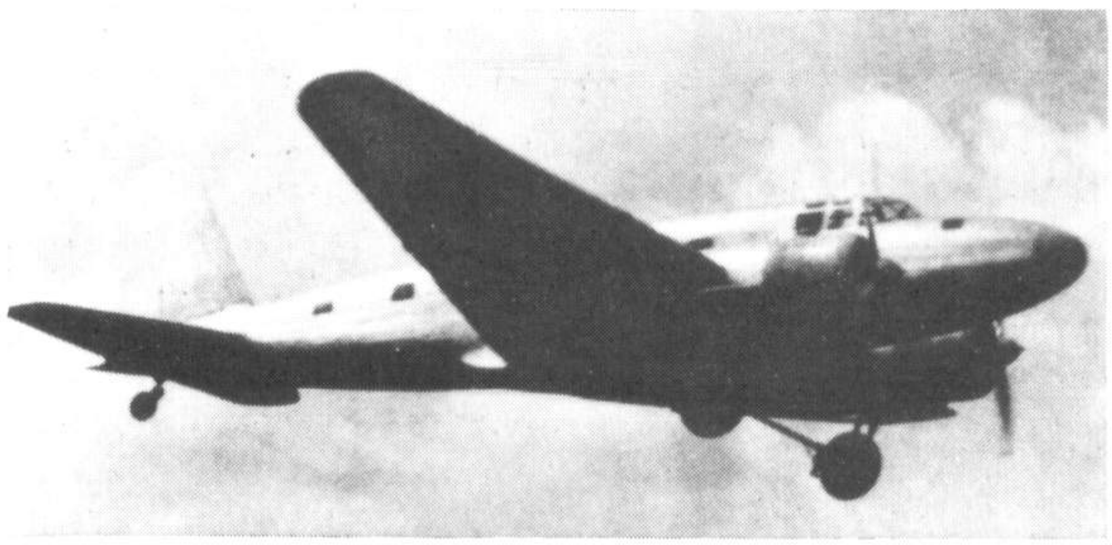
Despite heavy losses in every theatre of operation, the failure of the Nakajima Ki-49 to develop into an acceptable heavy bomber forced the continued use of the Ki-21 beyond its planned operational career. Only when the Mitsubishi Ki-67 "*Hiryu*" began reaching operational *Sentais* was the Ki-21 withdrawn from first line bomber units but the 58th *Sentai* retained its Army Type 97 Heavy Bomber in its original form until the Japanese surrender. Ki-21's retired from *Jubaku* (Heavy Bomber) *Sentais* were used as bomber trainers or for suicide attacks. Others were modified as transport for use by Headquarters flights or for special missions. The 3rd *Dokuritsu Hikotai* (Independent Wing) was one of the units which operated Ki-21's on special missions, and, on 24th May, 1945, nine of its aircraft loaded with specially trained commandos took off from Southern Kyushu for a raid on the American installations on Okinawa. Only one aircraft, shown in the accompanying five-aspect painting, made it to Yontan airfield where it landed on its belly in front of parked U.S. aircraft. Twelve troops ran out and, before being overrun, destroyed seven aircraft, blew up a vast quantity of ammunition and burnt 2,600 drums of petrol. This was Sally's swan song.

## THE Ki-21-IIb DESCRIBED

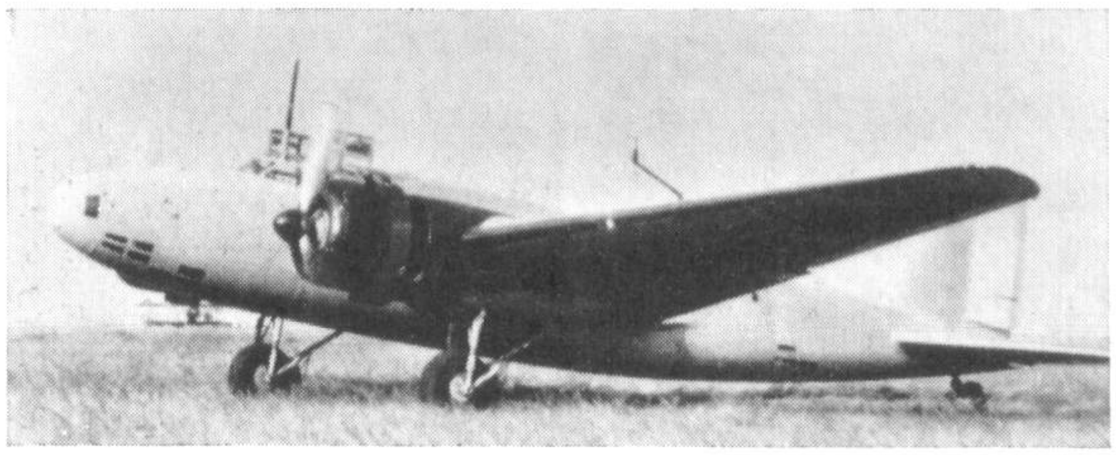
The Army Type 97 Heavy Bomber Model 2B was a twin-engined aircraft of conventional design.

**Wings:** Mid-wing cantilever all-metal monoplane. In three sections, comprising a narrow centre-section and two tapering outer sections. Dihedral on outer sections. Structure consisted of three spars with light alloy stressed-skin covering. Split hydraulically-operated metal flaps running from the centre-section to ailerons. Metal framed ailerons with fabric covering.

**Fuselage:** Oval metal semi-monocoque structure with stressed-skin covering. Bomb-bay under the wing centre-section. Entrance door on the port rear fuselage side. Two petrol tanks over the wing centre-



(Above) *The prototype MC-20 in unmarked natural metal finish; and* (below) *an MC-20-I as it appeared late in its career, with faired-over gun positions.*
(Photos: U.S.A.F. and the author)



* *Nakajima Ki-43, see* Profile *No. 46.*

section on the starboard side of the fuselage with a gangway on the port side linking the front and rear crew compartments. The rear compartment, normally occupied by gunners, could be fitted with jump seats providing accommodation for nine troops.

**Tail Unit:** Cantilever monoplane type of high aspect ratio with straight taper on leading edge of tailplane and trailing edge of elevators. Tall single fin and rudder. Metal framed, fabric covered, rudder and elevators fitted with adjustable trim-tabs.

**Undercarriage:** Retractable main undercarriage. Each independent unit, comprising two oleo shock-absorber legs and a backwardly-inclined forked strut, was hydraulically raised upwards and forwards round the hinge points of the forked struts into the engine nacelles. In retracted position the wheels were covered with hinged doors. Non-retractable, free swivelling tail wheel.

**Powerplant:** Two 1,450 h.p. Army Type 100 (Mitsubishi Ha-101) fourteen-cylinder double-row radial air-cooled engines. Take-off rating: 1,500 h.p. at 2,450 r.p.m. Military rating: 1,450 h.p. at 2,350 r.p.m. and 2,600 m. (8,530 ft.) and 1,340 h.p. at 2,350 r.p.m. and 4,600 m. (15,090 ft.). War Emergency rating: 1,580 h.p. at 2,450 r.p.m. and 2,300 m. (7,545 ft.). Three-bladed hydraulic constant-speed airscrews with metal blades. Fuel carried in four wing tanks and two fuselage tanks with laminated rubber protection. Auxiliary unprotected fuel tank in rear bomb-bay. Total fuel capacity: 3,135 litres (690 Imp. gallons). Unprotected oil tanks in the wing leading-edge outboard of the engine nacelles.

**Accommodation:** Normal crew of five consisting of pilot, co-pilot, navigator/bombardier, radio-operator/gunner, and gunner. Two additional gunners could be carried as required.

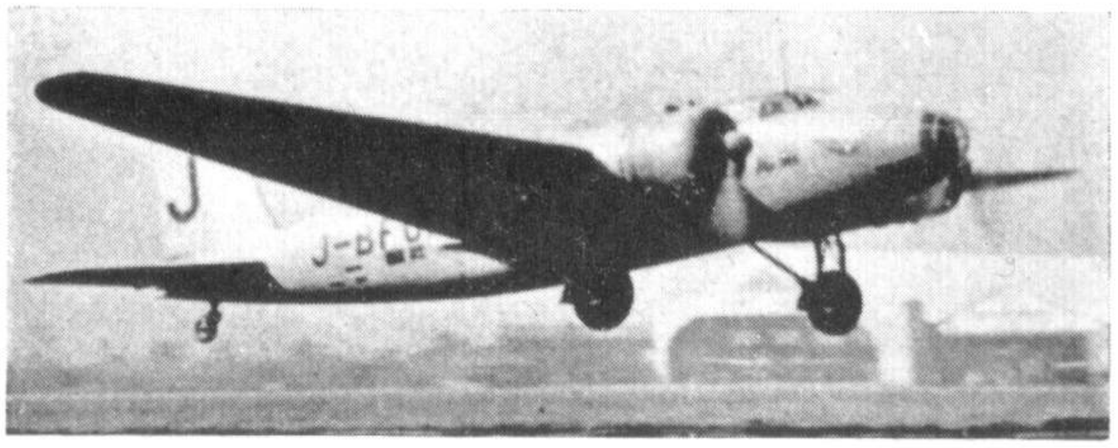
**Armament:** One manually-operated flexible 7·7 mm. Type 89 machine gun in each of the nose, ventral tunnel and two lateral positions. One remote-controlled 7·7 mm. Type 89 machine gun in extreme tail of fuselage with a maximum angle of fire of 15° in either direction. Maximum internal bomb load: 1,000 kg. (2,205 lb.) consisting of either sixteen 50 kg. bombs, nine 100 kg. bombs, four 250 kg. bombs or two 500 kg. bombs. When the bomb-bay tank was fitted four 50 kg. bombs could be carried externally.

## TRANSPORT VERSIONS

In December, 1938 two of the Japanese airlines, Japan Air Transport Co., and International Air Lines, merged to establish Japan Air Lines Co. Amongst modern aircraft in their fleet the new company had a number of imported and licence-built Douglas DC-2's and DC-3's and Lockheed 14-WG3's as well as a variety of aircraft of domestic design. One of the first tasks of the new company was to investigate the possibility of obtaining a modern transport aircraft locally designed to fly the Japanese flag on international routes. As the Army Type 97 Heavy Bomber was then demonstrating in China performances similar to those sought by Japan Air Lines for their new aircraft, they approached *Mitsubishi Jukogyo K.K.* with a request for a transport version of the Ki-21. Initial design proposals by Mitsubishi attracted the attention of the Imperial Japanese Army as the proposed aircraft could satisfy their requirement for a paratroop and staff transport. Consequently in August, 1939, shortly after Japan Air Lines Co. had been once again reorganized as the Greater Japan Air Lines Co. (*Dai Nippon Koku K.K.*)—a national airline with 37¼% of the capital in the hands of the Japanese Government—the Imperial Japanese Army instructed Mitsubishi to modify the Army Type 97 Heavy Bomber for use as a passenger transport aircraft. The transport aircraft, which received the military *Kitai* number Ki-57 and the civil designation MC-20, was to have a crew of four and to carry eleven passengers and 300 kg. (661 lb.) of freight over 1,400 km. (870 miles) at a cruise speed of 300 km./h. (186 m.p.h.) between 2,000 and 4,000 metres (6,560 and 13,120 feet). With reduced payload the range requirement was initially 2,000 km. (1,243 miles), this being later increased to 3,000 km. (1,864 miles). Maximum weight was not to exceed 7,900 kg. (17,417 lb.).

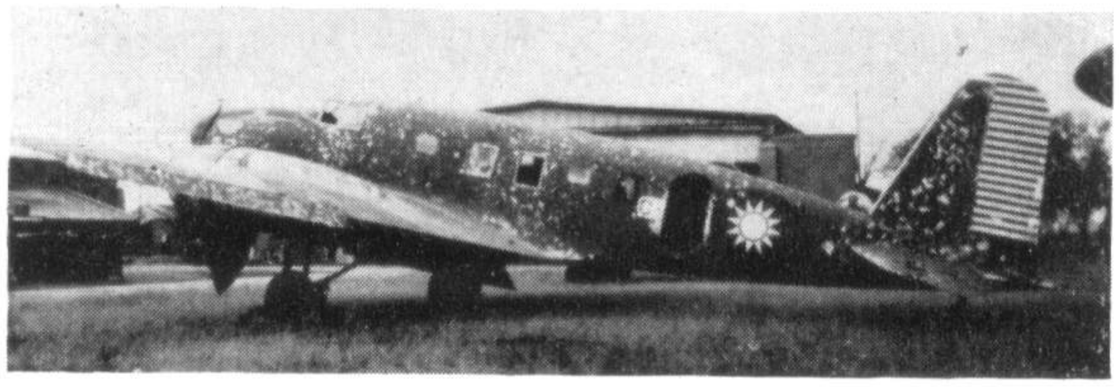
Whilst Mitsubishi proceeded with the design of the Ki-57, *Dai Nippon Koku K.K.* received a small number of Ki-21-Ia's, taken out of operation in China due to their insufficient armament, for pilot familiarization and cargo flights between Japan and Manchuria and China. The first of these aircraft, designated MC-21 for Mitsubushi Commercial Twenty-one—indicating it was a version of the military Ki-21—was received by *Dai Nippon Koku* in February, 1940. All armament and military equipment was removed but, initially, the glazed nose and dorsal greenhouse were retained. Later these positions were faired over, giving to the aircraft a smoother aerodynamic finish resulting in superior performances to either the Ki-21-I or Ki-57-I powered by the same Nakajima Ha-5 engines. These aircraft were mainly used between Japan and Manchuria for freight operations but could be converted to carry nine passengers in a primitive cabin. Known registrations of MC-21's include: *J-BFOA* "Hiei" and *J-BEOW*.

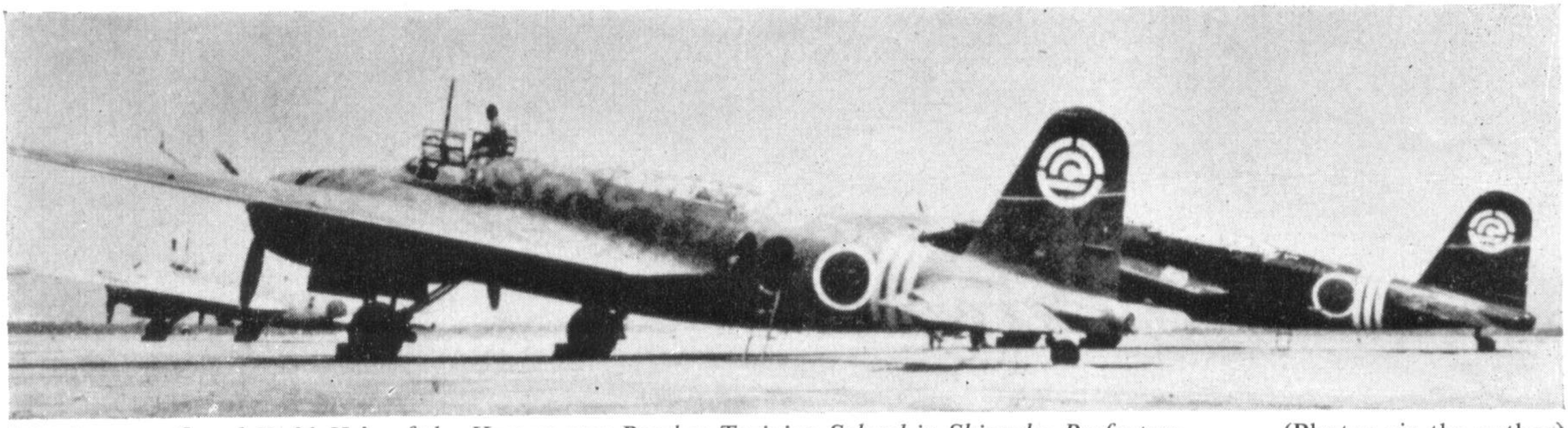
The prototype for the Ki-57/MC-20 series was completed in July, 1940 and flight testing began the following month. The aircraft was characterized by a new fuselage accommodating eleven passengers in two rows of seats—one on each side of a central aisle—but retained the wing, powerplant installation, undercarriage, tail section and cockpit of the military bomber. As could be logically anticipated from such a degree of commonality, few problems were encountered during flight trials. However, during a test



*J-BFOA "Hiei", the first MC-21 cargo transport modified from a Ki-21-I; note that the aircraft still retained the glazed nose and carried the insignia of the* Dai Nippon Koku K.K. *ahead of the cockpit.* (Photo: Passingham/Klepacki Coll.)

*An MC-20-II formerly of* Dai Nippon Koku K.K. *repainted with Chinese national insignia.* (Photo: via the author)

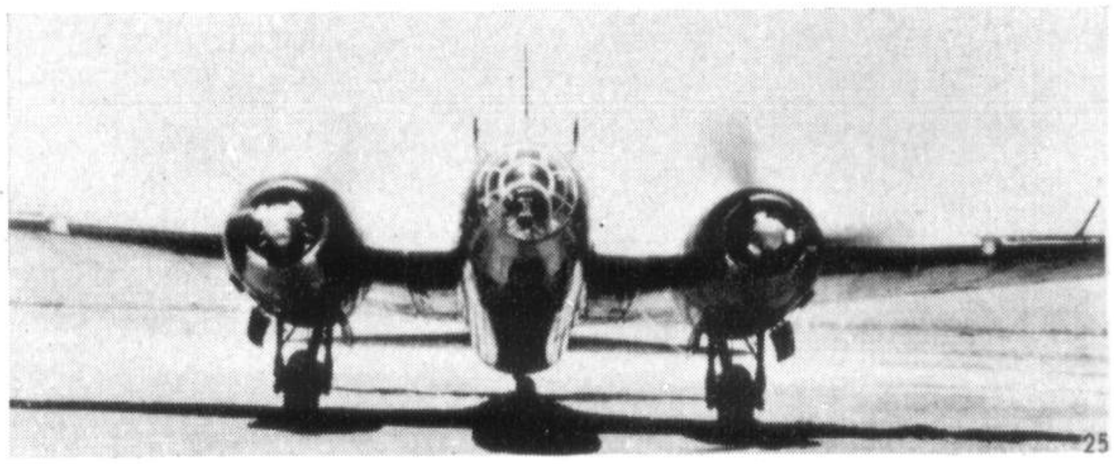




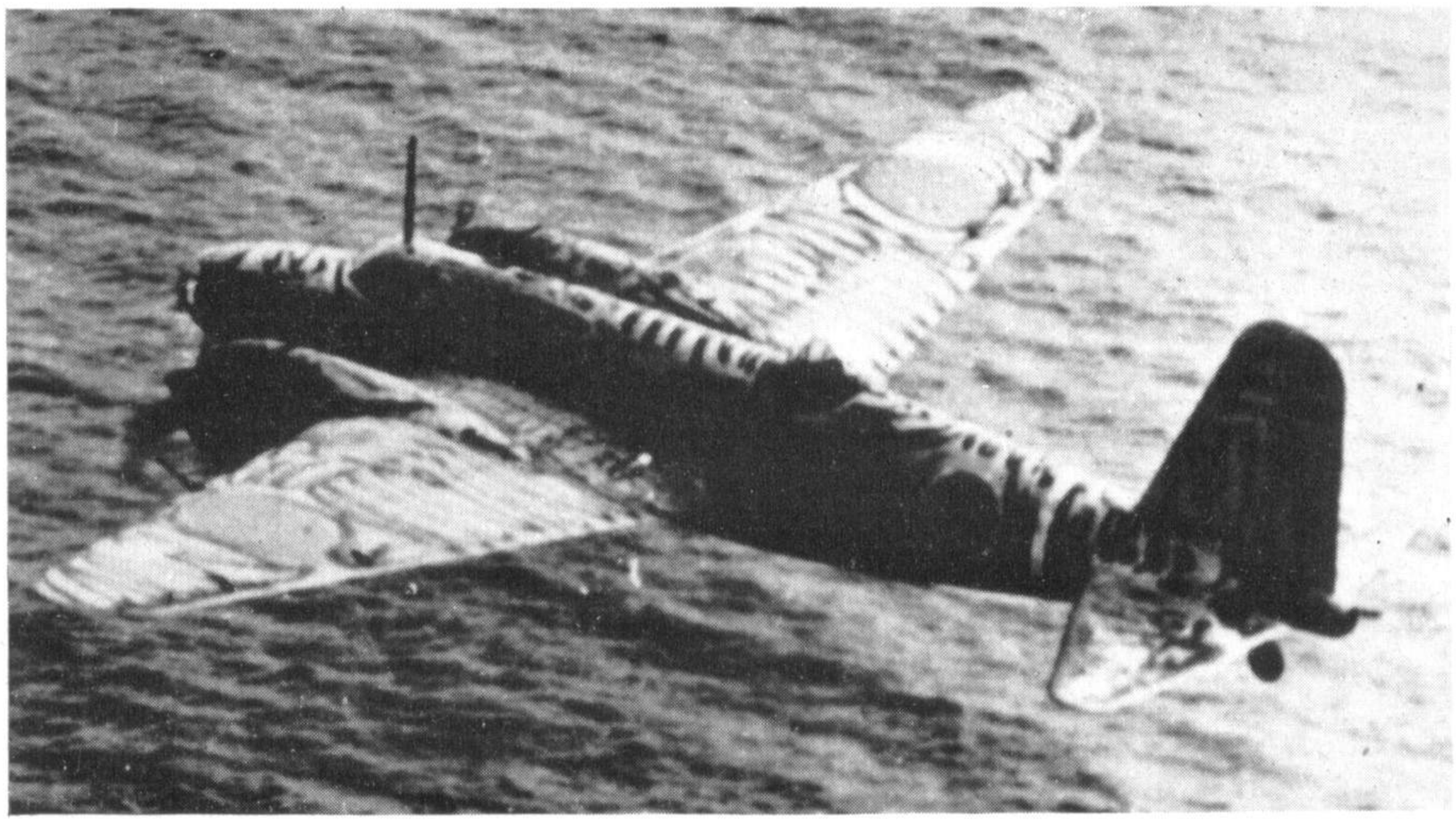
*Mottle-camouflaged Ki-21-IIa's of the Hamamatsu Bomber Training School in Shizuoka Prefecture.* (Photo: via the author)

conducted by the Civil Aviation Bureau in December, 1940, the fourth aircraft built crashed off Chiba in Tokyo Bay killing all fourteen persons aboard. Despite this accident production of the aircraft went ahead as the Army Type 100 Transport Model 1 (Ki-57-I) for the Imperial Japanese Army and as the MC-20-I for *Dai Nippon Koku K.K.* In civil service the aircraft was flown on scheduled operations between Japan and the South-east Asia continent and the islands in the South-west Pacific as well as on contract operations for the Imperial Japanese Army. The military version—a few of which were transferred to the Imperial Japanese Navy as Mitsubishi L4M1, Navy Type O Transport—operated on all fronts as a communication aircraft, logistic transport and para-troop transport and obtained from Allied Intelligence the code name "Topsy". A total of 101 Ki-57-I's and MC-20-I's were built by Mitsubishi between 1940 and 1942.

The most famous operation in which Army Type 100 transports took part was the paratroop attack on aerodromes and oil refineries around Palembang, Sumatra, on 14th February, 1942. The capture of the oil refineries and adjacent airfields was of paramount importance for the Japanese as in 1940 Japan derived some 40 per cent. of her oil supplies, including high octane petrol for aircraft use, from Sumatra. A seaborne invasion force set out from Cam Ranh Bay, French Indo-China, on 9th February but the danger existed that the Allies would destroy the refineries before their capture by the Japanese. Consequently the Imperial Japanese Army mounted one of their few airborne assaults of the war. Troops of the 1st *Teishin Rentai* (1st Raiding Regiment) were assembled at Kahang and Kluang, Malaya, and were transported to their targets by Ki-57-I's of the 1st *Teishin Hikosentai* (1st Raiding Air Regiment). Early in the morning on 14th February, after bombers had drenched P.1 aerodrome—near Palembang—with light bombs and their large escort of fighters swept it with gunfire, the transports came in through furious but inaccurate anti-aircraft fire and dropped some 260 paratroops over the field from an altitude of 200 m. (660 ft.). After a few skirmishes during which the Allied troops exhausted their meagre supply of ammunition, P.1 had to be abandoned to the invaders. About the same time, some 100 Japanese paratroops descended over the oil refinery area several miles from the airfield. At the refinery the paratroops met with stiff resistance and were forced to use air raid shelters as trenches. The refinery at Pledju



(Above) *Head-on view of the Army Type 97 Heavy Bomber Model 2; note the wheel-well fairing doors which characterised this version.* (Photo: the author)



Left: *A Ki-21-IIb flying low over the water; note dorsal turret and "tail stinger".* (Photo: Imp. War Mus. TC24132)

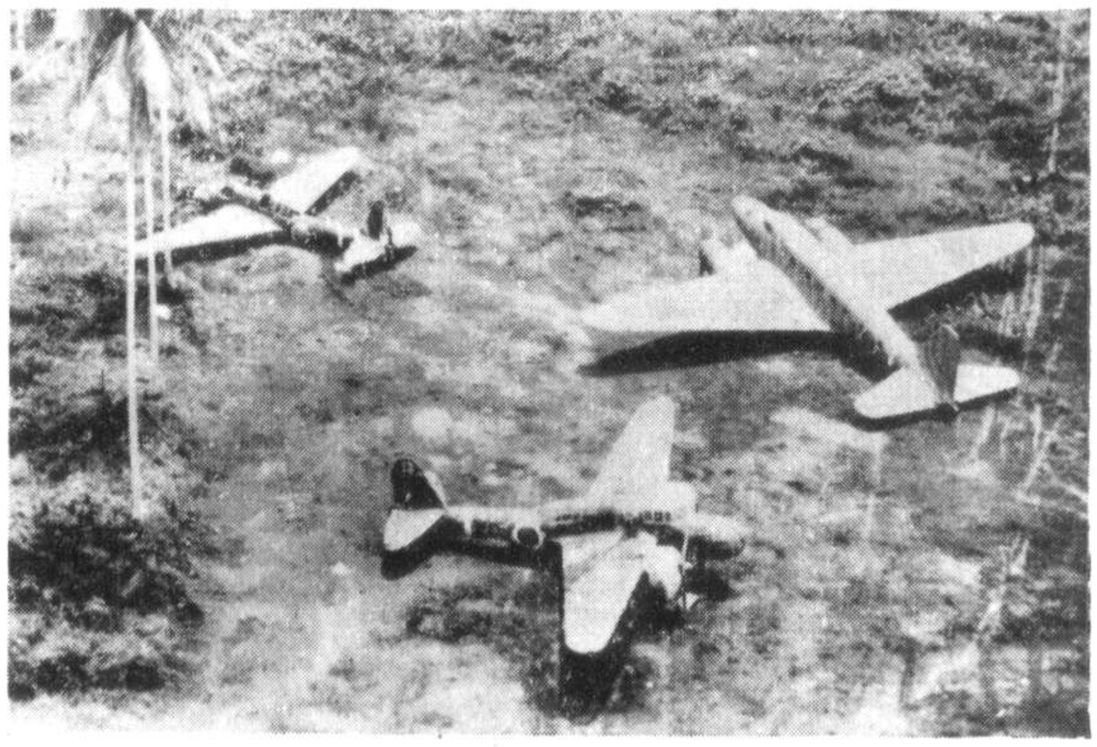
had been only slightly damaged and the paratroops occupied it the next day, permitting immediate use. The refinery at Sungei Gerong had been damaged by fire but could still be used. When reinforced by air on the afternoon of the 15th the airborne force had left a guard at the aerodrome and moved on Palembang in combat formation. Late that afternoon the town was occupied, the advanced seaborne force disembarking that night. About a week later the airborne force returned to its base. The paratroops and their Ki-57-I's had saved the rich Sumatra oil fields for the Japanese war machine.

In March, 1941, Mitsubishi had been instructed by the Imperial Japanese Army to develop a higher performance version of the Ki-57 making use of the aerodynamic improvement of the Ki-21-II bomber. The improved Ki-57-II used the redesigned engine nacelles of the Ki-21-II but made use of a pair of 1,080 h.p. Mitsubishi Ha-102 radials and did not feature the main wheel well fairing panels. Four hundred and six aircraft of this type were built between May, 1942 and January, 1945 by Mitsubishi as the Army Type 100 Transport Model 2 and MC-20-II (civil version). Plans to have the aircraft manufactured by *Nippon Kokusai Kogyo K.K.* which had been initiated in 1944 failed to materialize. The Ki-57-II's and MC-20-II's saw extensive use with the Imperial Japanese Army and *Dai Nippon Koku K.K.* throughout the war. Following the Japanese surrender, all flights of Japanese aircraft were banned on 24th August, 1945. However, so thorough had been the work of Allied carrier-borne aircraft in disrupting ground communication facilities, that it became necessary on 15th September to authorize resumption of flight operation by *Dai Nippon Koku K.K.* under strict supervision by the Allies. Conspicuously marked with the Green Cross against white background, the MC-20's once again took to the air until final cancellation of Japanese air activity on 10th October, 1945. It only remained for the MC-20 to join other Japanese aircraft on the pyre.

© *René J. Francillon, 1967.*

*Late in the war, many Ki-21's were destroyed on their airfields or during local flights by the Allied aircraft which had gained almost total air superiority in the South-East Asian theatre.* (Below, top to bottom) *A Ki-57-II and two Ki-48's surprised on their field by an Allied reconnaissance machine. A 14th* Sentai *Ki-21-IIb about to receive a "para-frag"—parachute fragmentation bomb—which were widely used by the U.S. Fifth Air Force in attacks on Japanese airfields. Another aircraft from the 14th* Sentai *caught at low altitude by a flight of Fifth Air Force B-25's. Seconds after this photograph was taken, the Ki-21-IIb was shot down into the jungle.*

(Photos: via the author)



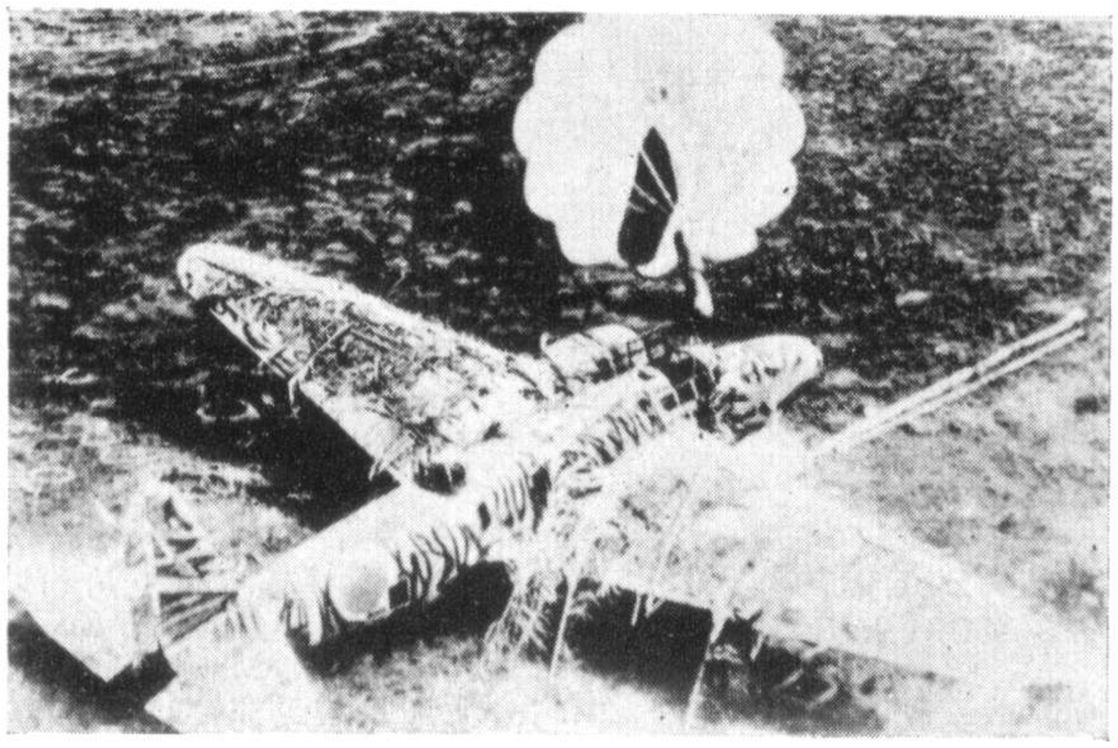
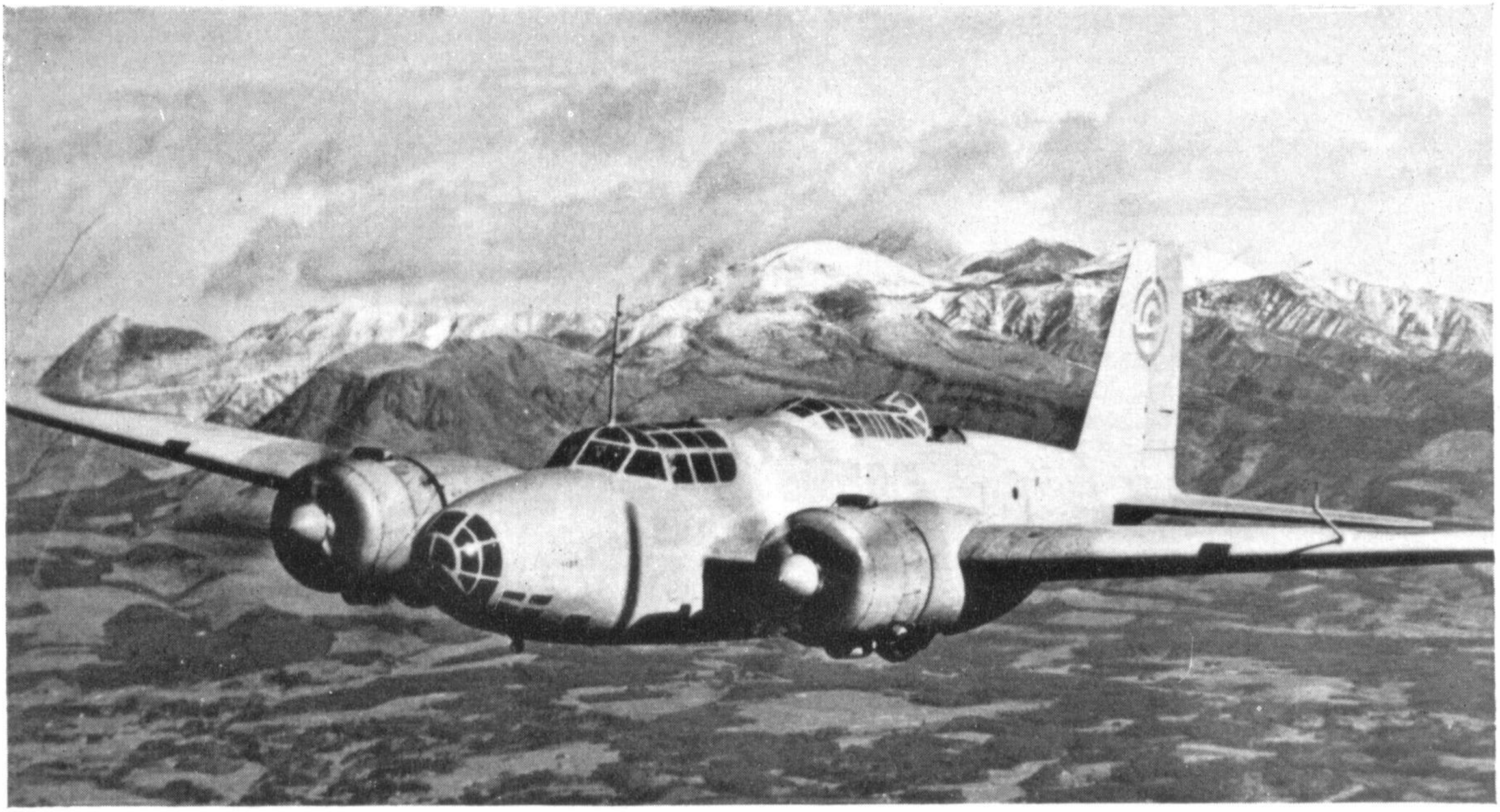


**TABLE I.—Service Deployment of the Ki-21**

| *Unit* | *Period* | *Theatres of operation* |
|---|---|---|
| 7th Sentai | 1941–1943 | French Indo-China, Malaya, Dutch East Indies, New Guinea. |
| 12th Sentai | 1940– | China. |
| 14th Sentai | 1940–1944 | French Indo-China, Malaya, Dutch East Indies, New Guinea, Philippines. |
| 58th Sentai | Feb. 1943–Aug. 1945 | Manchuria, China, Malaya, Sumatra, Thailand, French Indo-China, Formosa. |
| 60th Sentai | Aug. 1938–Sept. 1941 | China. |
| 61st Sentai | March 1939–Feb. 1942 | Manchuria, China. |
| 62nd Sentai | Nov. 1940–Dec. 1943 | Japan, China. |
| 92nd Sentai | — | — |
| 94th Sentai | — | — |
| 95th Sentai | Dec. 1942–Jan. 1944 | — |
| 98th Sentai | July 1943–Feb. 1944 | Sumatra, Malaya, Burma, Japan. |
| 3rd Dokuritsu Hikotai | Nov. 1944–June 1945 | Japan, Okinawa. |
| 22nd Hikodan, Shireibu Hikohan | April 1942–Aug. 1945 | Philippines, Japan, Formosa. |
| 1st Hikoshidan Shireibu Hikohan | July 1943–Aug. 1945 | Japan, Philippines. |
| 5th Hikoshidan Shireibu Hikohan | Oct. 1943–Aug. 1945 | Burma, Thailand, French Indo-China. |
| 8th Hikoshidan Shireibu Hikohan | July 1944–Aug. 1945 | Formosa. |
| Hamamatsu Army Flying School | 1941–June 1944 | Japan. |



*A fine flying study of a Hamamatsu School machine, in this case a Ki-21-Ia. Note the rear portion of the dorsal "greenhouse" lifted to provide a windbreak for the gunner when manning the 7·7 mm. Type 87 machine gun on a flexible rear mounting.*
(Photo: R. Bueschel)

### J.A.A.F. Bomber Unit Structure

The Table of Equipment strength of a *Jubaku* (Heavy Bomber) *Sentai* was 28 aircraft organized in three *Chutais* of 9 aircraft each plus the commanding officer's aircraft. Operational strength, however, was usually below the Table of Equipment strength. *Jubaku Sentai* were normally commanded by a Lieutenant Colonel or Major.

The next unit in the command chain was the *Hikodan*, normally commanded by a Major-General or Colonel. They consisted of a small headquarters, a reconnaissance unit and usually any combination of three *Sentoki* (Fighter) *Sentais*, *Keibaku* (Light Bomber) *Sentais* and/or *Jubaku* (Heavy Bomber) *Sentais*. Two or three *Hikodans* formed the *Hikoshidan* and the *Kokugun* grouped two or three *Hikoshidans*.

No direct equivalent of Japanese units existed in the R.A.F. or U.S.A.A.F. and, consequently, the names of these units have been variously translated as follows:

*Chutai*—Flight or Squadron or Company.

*Sentai Hombu*—H.Q. Section.

*Hikodan*—Wing or Air Brigade.

*Kokugun*—Air Army.

*Sentai*—Group or Regiment.

*Shireibu Hikohan*—Command Section or H.Q. Flight.

*Hikoshidan*—Air Division.

### TABLE II.—Service Deployment of the Ki-57

| *Unit* | *Period* | *Theatres of operation* |
|---|---|---|
| 108th Sentai | Oct. 1944–Aug. 1945 | — |
| 109th Sentai | Oct. 1944–Aug. 1945 | Malaya, Sumatra, French Indo-China. |
| 20th Dokuritsu Hiko Chutai | March 1943–May 1945 | Japan, Rabaul, New Guinea. |
| 7th Hikodan, Shireibu Hikohan | July 1941–Aug. 1945 | China, French Indo-China, Thailand, Malaya, Burma, Philippines, Borneo, Japan. |
| 4th Hikoshidan, Shireibu Hikohan | 1942–Aug. 1945 | Manchuria, Philippines, Japan. |
| 9th Hikoshidan, Shireibu Hikohan | Dec. 1943–Aug. 1945 | Sumatra, Malaya, Celebes, Java, Philippines, Formosa, French Indo-China, Borneo, Japan. |
| 2nd Shudan, Shireibu Hikohan | July 1941–July 1942 | Manchuria. |
| 2nd Kokugun, Shireibu Hikohan | July 1942–Aug. 1945 | Manchuria. |
| 3rd Kokugun, Shireibu Hikohan | 1942–Aug. 1945 | Burma, Thailand, French Indo-China. |
| 4th Kokugun, Shireibu Hikohan | Nov. 1943–Feb. 1945 | New Britain, New Guinea, Celebes, Philippines. |
| 6th Kokugun, Shireibu Hikohan | Dec. 1944–Aug. 1945 | Japan. |
| 1st Teishin Hikosentais | 1941–1942 | Malaya, Dutch East Indies. |

### TABLE III.—Production

A total of 2,064 Ki-21's were built by Mitsubishi Jukogyo K.K. at Nagoya and Nakajima Hikoki K.K. at Ota as follows:

*Mitsubishi Jukogyo K.K.*

8 prototypes and service trial aircraft (Nov. 1936–Feb. 1938).
143 Ki-21-Ia production aircraft (March 1938–1939).
120 Ki-21-Ib production aircraft (1939–1940).
160 Ki-21-Ic production aircraft (1940).
4 Ki-21-II Service trial aircraft (December 1940).
590 Ki-21-IIa production aircraft (Dec. 1940–1942).
688 Ki-21-IIb production aircraft (1942–Sept. 1944).

1,713

*Nakajima Hikoki K.K.*

351 Ki-21-Ia -Ib and -Ic production aircraft (Aug. 1938–Feb. 1941).

An unknown number of Ki-21-I's were modified as MC-21 Transport aircraft.

A total of 507 MC-20'sand Ki-57's were built by Mitsubishi Jukogyo K.K. as follows:

*Model 1*
27 in fiscal year 1940 (July 1940–March 1941).
69 in fiscal year 1941 (April 1941–March 1942).
5 in fiscal year 1942 (April–May 1942).

101

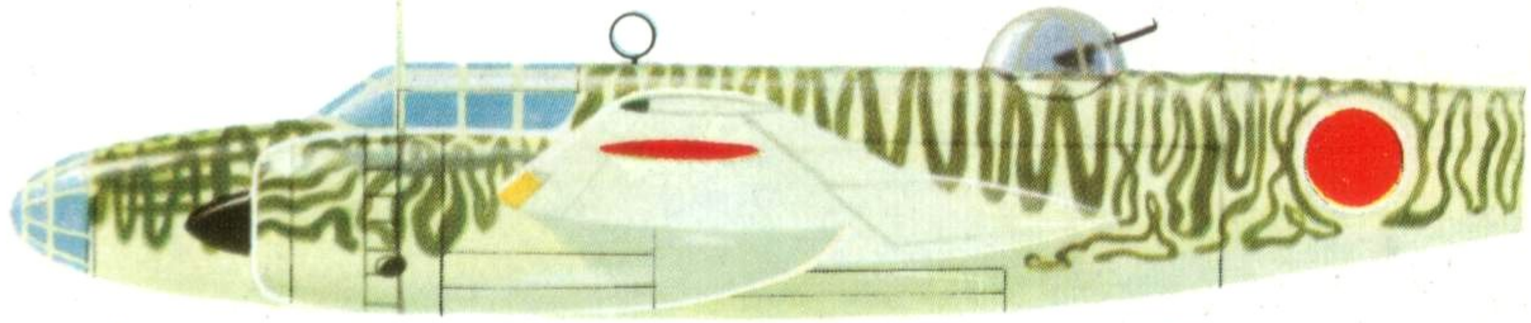
*Model 2*
72 in fiscal year 1942 (May 1942–March 1943).
221 in fiscal year 1943 (April 1943–March 1944).
113 in fiscal year 1944 (April 1944–January 1945).

406

Ki-21-IIb, 98th Group, 2nd Squadron, during operations against Calcutta, India, December 1943.

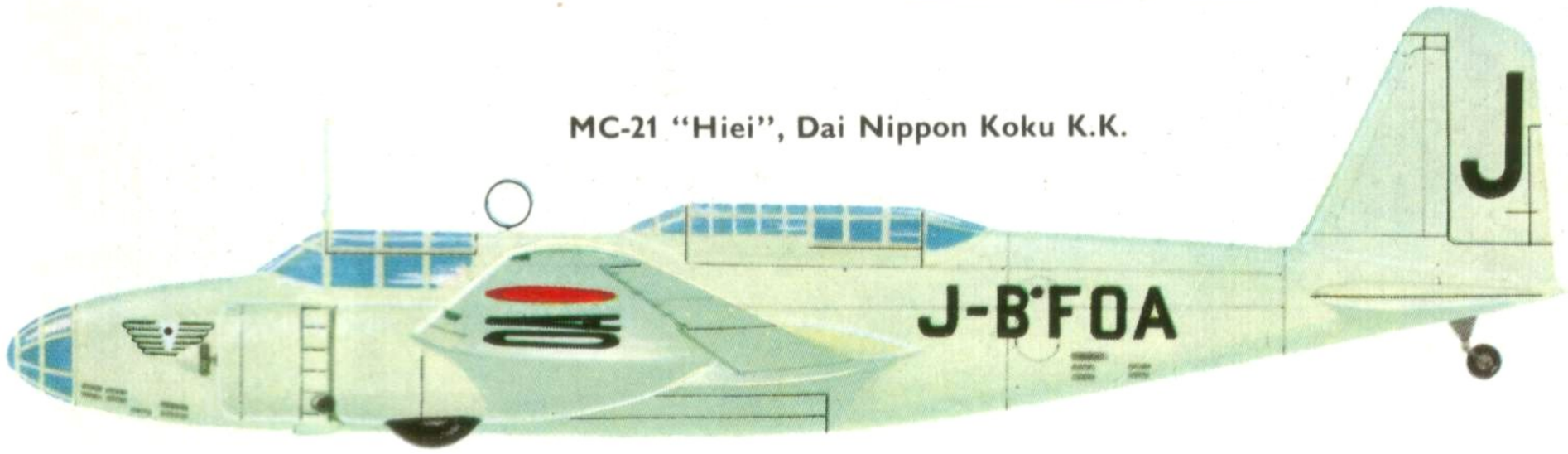
14th Grp., 1st Sqdn.

Ki-21-IIb, 14th Group, 1st Squadron, Philippines, 1944.



Dai Nippon Koku K.K.

MC-21 "Hiei", Dai Nippon Koku K.K.

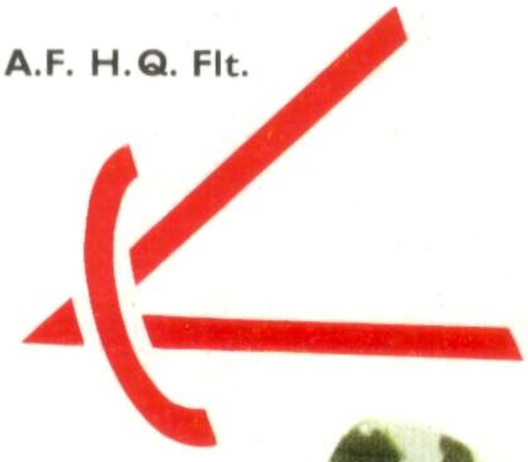


109th Grp., 3rd Sqdn.

Ki-57-II, 109th Group, 3rd Squadron, Malaya, 1944.

9th Air Div. H.Q. Flt.

6th A.F. H.Q. Flt.

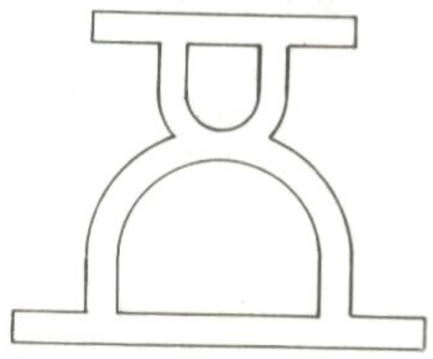


Ki-57-II, 9th Air Division H.Q. Flight, Borneo, 1945.

Ki-57-II, 6th Air Force H.Q. Flight, Japan, 1945.

7th Wing H.Q. Flt.

Ki-57-I, 7th Wing H.Q. Flight, French Indo-China, 1941.



5th Air Div. H.Q. Flt.

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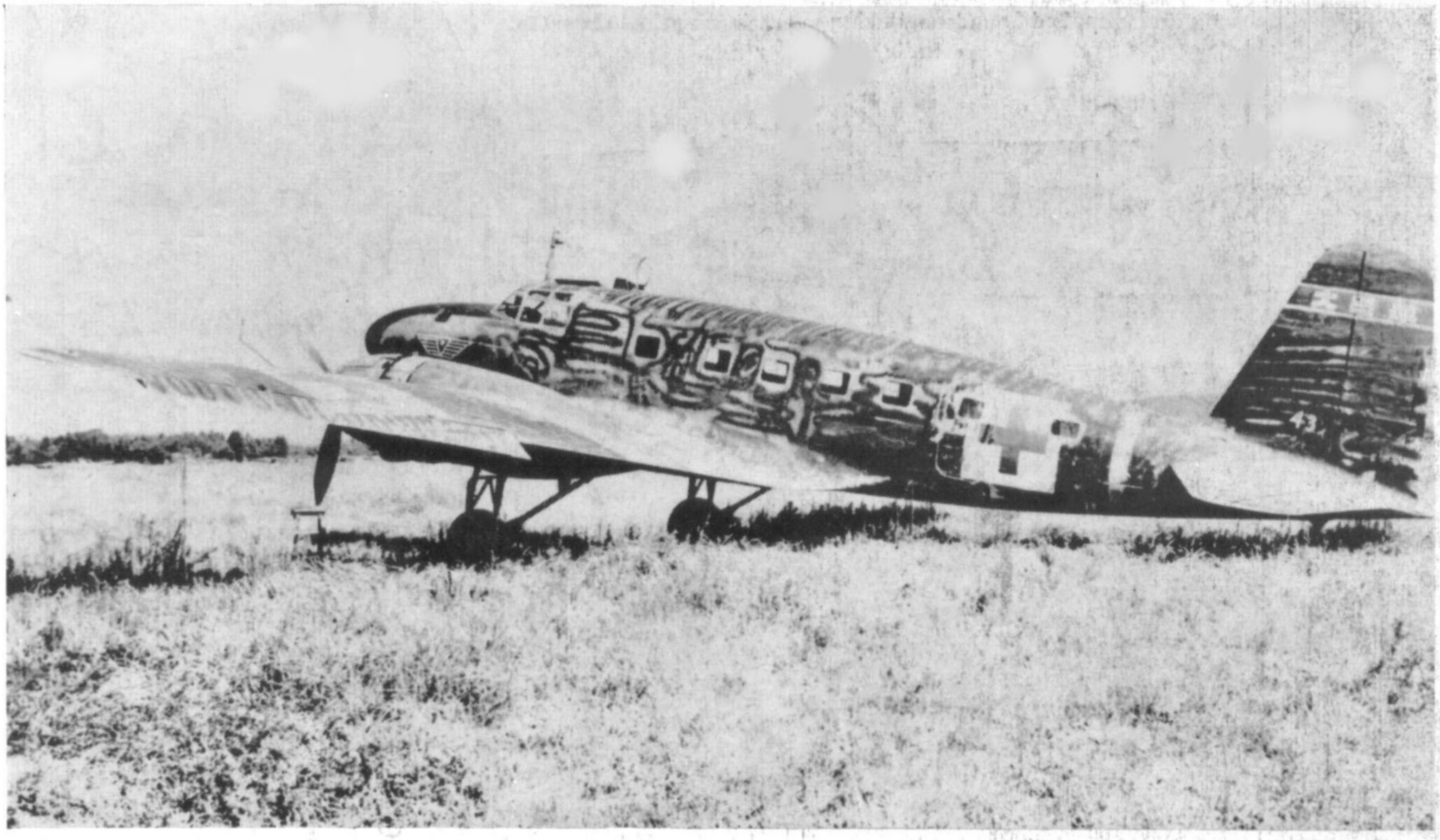

*A captured MC-20-II of* Dai Nippon Koku K.K., *bearing the green surrender crosses. Late in the war civil aircraft were camouflaged, and identified by a white fuselage band outlined in red.* (Photo: via the author)

**TABLE IV—Specifications**

| | Ki-21-Ia | Ki-21-IIb | Ki-57-I | Ki-57-II |
|---|---|---|---|---|
| Span | 22·50 m. (73 ft. 9 13/16 in.) | 22·50 m. (73 ft. 9 13/16 in.) | 22·60 m. 74 ft. 1 3/4 in. | 22·60 m. (74 ft. 1 3/4 in.) |
| Length | 16·00 m. (52 ft. 5 29/32 in.) | 16·00 m. (52 ft. 5 29/32 in.) | 16·10 m. (52 ft. 9 7/8 in.) | 16·10 m. (52 ft. 9 7/8 in.) |
| Height | 4·35 m. (14 ft. 3 13/32 in.) | 4·85 m. (15 ft. 10 15/16 in.) | 4·77 m. (15 ft. 7 25/32 in.) | 4·86 m. (15 ft. 11 11/32 in.) |
| Wing Area | 69·60 sq. m. (749·165 sq. ft.) | 69·60 sq. m. (749·165 sq. ft.) | 70·08 sq. m. (754·332 sq. ft.) | 70·08 sq. m. (754·332 sq. ft.) |
| Empty Weight | 4,691 kg. (10,342 lb.) | 6,070 kg. (13,382 lb.) | 5,522 kg. (12,174 lb.) | 5,585 kg. (12,313 lb.) |
| Loaded Weight | 7,492 kg. (16,517 lb.) | 9,710 kg. (21,407 lb.) | 7,860 kg. (17,328 lb.) | 8,173 kg. (18,018 lb.) |
| Maximum Weight | 7,916 kg. (17,452 lb.) | 10,610 kg. (23,391 lb.) | 8,437 kg. (18,600 lb.) | 9,120 kg. (20,106 lb.) |
| Wing Loading* | 107·6 kg./sq. m. (22·0 lb./sq. ft.) | 139·5 kg./sq. m. (28·6 lb./sq. ft.) | 112·2 kg./sq. m. (23·0 lb./sq. ft.) | 116·6 kg./sq. m. (23·9 lb./sq. ft.) |
| Power Loading* | 3·9 kg./h.p. (8·7 lb./h.p.) | 3·2 kg./h.p. (7·1 lb./h.p.) | 4·1 k.g./h.p. (9·1 lb./h.p.) | 3·8 kg./h.p. (8·3 lb./h.p.) |
| Fuel Capacity | 2,635 l. (580 Imp. gallons) | 3,135 l. (690 Imp. gallons) | 2,500 l. (550 Imp. gallons) | 2,500 l. (500 Imp. gallons |
| Engine | 2×Ha-5 Kai | 2×Ha-101 | 2×Ha-5 Kai | 2×Ha-102 |
| Take-off Rating | 950 h.p. | 1,500 h.p. | 950 h.p. | 1,080 h.p. |
| Military Rating | 1,080 h.p. at 4,000 m. (1,080 h.p. at 13,125 ft.) | 1,340 h.p. at 4,600 m. (1,340 h.p. at 15,090 ft.) | 1,080 h.p. at 4,000 m. (1,080 h.p. at 13,125 ft.) | 1,055 h.p. at 2,800 m. (1,055 h.p. at 9,185 ft.) |
| Maximum Speed | 432 km./h. at 4,000 m. (268 m.p.h. at 13,125 ft.) | 486 km./h. at 4,720 m. (302 m.p.h. at 15,485 ft.) | 430 km./h. at 3,400 m. (267 m.p.h. at 11,155 ft.) | 470 km./h. at 5,800 m. (292 m.p.h. at 19,030 ft.) |
| Cruise Speed | — — | 380 km./h. at 5,000 m. (236 m.p.h. at 16,405 ft.) | 320 km./h. at 3,000 m. (199 m.p.h. at 9,840 ft.) | — — |
| Climb to | 5,000 m. (16,405 ft.) | 6,000 m. (19,685 ft.) | 5,000 m. (16,405 ft.) | 5,000 m. (16,405 ft.) |
| in | 13 min. 55 sec. | 13 min. 13 sec. | 12 min. 1 sec. | 15 min. 45 sec. |
| Service Ceiling | 8,600 m. (28,215 ft.) | 10,000 m. (32,810 ft.) | 7,000 m. (22,965 ft.) | 8,000 m. (26,250 ft.) |
| Range:—Normal | 1,500 km. (932 ml.) | 2,700 km. (1,680 ml.) | 1,500 km. (932 ml.) | 1,500 km. (932 ml.) |
| —Maximum | 2,700 km. (1,680 ml.) | — — | 3,000 km. (1,865 ml.) | 3,000 km. (1,865 ml.) |
| Defensive Armament | 3×7·7 mm. | 5×7·7 mm. and 1×12·7 mm. | — | — |
| Bomb load:—Normal | 750 kg. (1,653 lb.) | 750 kg. (1,653 lb.) | — | — |
| —Maximum | 1,000 kg. (2,205 lb.) | 1,000 kg. (2,205 lb.) | — | — |

* At normal loaded weight and take-off rating.

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